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WILD OXEN, SHEEP, & GOATS
OF ALL LANDS

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WILD OXEN, SHEEP, & GOATS OF ALL LANDS

LIVING AND EXTINCT

BY
R. LYDEKKER



LONDON
ROWLAND WARD, LIMITED.

1898

1380-1400
1400-1450
1450-1500

BIBLIOTHECA
REGIA
MONACENSIS

CORRIGENDA

Page 92. *Bos scaphoceros* turns out to be a sheep.

„ 156. Fig. 30 represents a female bharal.

„ 176 and 178. The face of *Ovis ammon* is white (or whitish) only in the summer coat of the typical race.

Page 233, line 7 from top, *for* white *read* black.

„ 260, line 15 from top, *for* 1796 *read* 1766.

„ „ line 21 from top, *for* 1874 *read* 1872.

Plate XV. The ruff on the throat is made too large and coloured too white.

Plate XX. There should be no white patch on the buttocks.

[*N.B.*—This may be painted out, as the plates are hand-coloured.]



PREFACE

IN its general treatment of the subject this volume follows the lines of *The Deer of All Lands*; generic and sub-generic groups, as well as species and sub-species, being, so far as possible, made to have the same relative rank as in the latter. A similar prominent position is also given to the English names of the various animals described.

Much that appears in the introductory portion of the companion volume has a bearing on the present work. And it has accordingly been deemed unnecessary to repeat either the distinctive characteristics of the group Pecora, the subdivisions of the Tertiary period, or the names and limits of the geographical regions into which the surface of the globe may be divided; all these being detailed in *The Deer of All Lands*.

One feature of the latter—the numerous photographs of living animals—will be missed in the present volume. But this is unavoidable, as there is no collection in this country of the animals described in the sequel comparable with the one which afforded the illustrations in question.

While the majority of the plates have been drawn by Mr. J. Smit, a few are from original and, with one exception, hitherto unpublished sketches by Mr. Joseph Wolf. For permission to reproduce these the author is

indebted to Lady Brooke and Sir Douglas Brooke, to whom the originals respectively belong. His thanks are likewise due to the Duchess of Bedford, Sir Edmund G. Loder, and Mr. David T. Hanbury for various illustrations; while acknowledgments must likewise be made for those borrowed from the works of Prince Demidoff and Mr. H. Z. Darrah.

HARPENDEN, *1st December* 1898.



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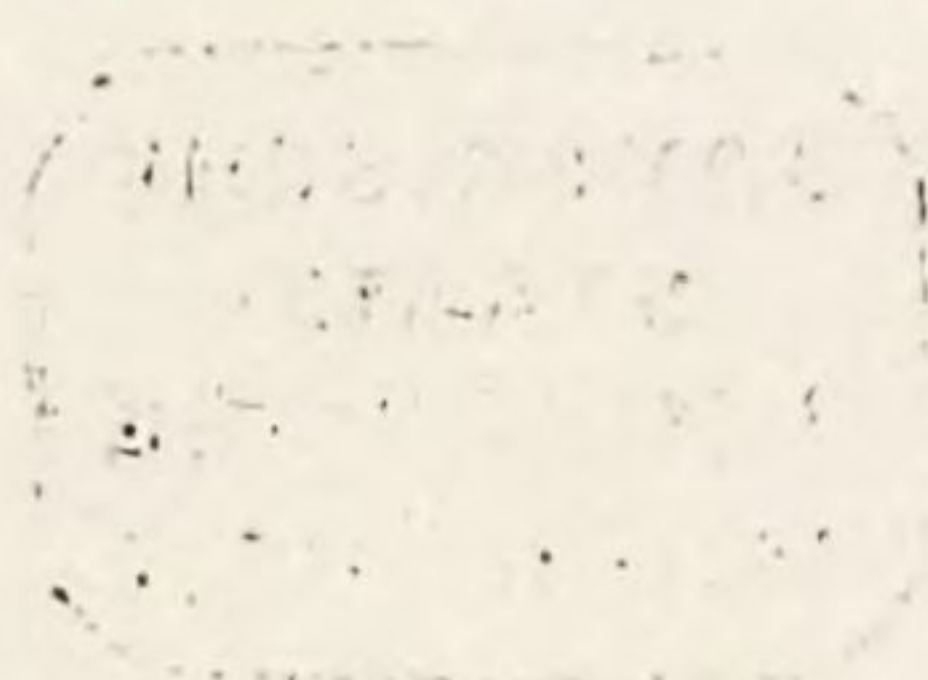
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ADDENDA TO "DEER OF ALL LANDS"

THE issue of the present volume affords a convenient opportunity for recording such amendments and additions to the *Deer of all Lands* as are necessary.

The hind figured on page 103 as that of the Manchurian wapiti proves to belong to the Duke of Bedford's deer. Consequently the redness and large size attributed to the former animal are not warranted by the facts.

A muntjac from Borneo named *Cervulus pleiharicus* by Kohlbrugge¹ in 1895 was overlooked; but its claims to specific distinction from the Indian muntjac are very doubtful.

The name *Dorcelaphus*, used in a sub-generic sense (p. 248) for one group of American deer, is antedated by *Odocoileus*, Rafinesque, 1832; and the latter is accordingly employed by Dr. Merriam.² It was given to a fossil tooth, now identified with the common American deer; and such an unsatisfactory type specimen may appear to some a good reason against its adoption. The specific name is *O. spelæus*.

Dr. Merriam³ also recognises two additional sub-species of the black-tailed deer, which he proposes to call *Odocoileus columbianus sitkensis* and *Odocoileus columbianus scaphiotus*; the former being from Alaska and the latter from California.

The same writer⁴ also names a deer allied to the mule-deer from Cerros Island, California, *Odocoileus cerrosensis*; a second⁵ from Chiapas, Mexico, *O. thomasi*, stated to differ from the common American deer by being red at all seasons; and a third⁶ from the same district, *O. nelsoni*.

The acquisition by the British Museum of a mounted specimen of the marsh-deer (p. 283) shows that the hair on the withers is reversed, as in the pampas deer, although to a smaller extent. The reversal of the hair in this region becomes therefore a characteristic of the sub-genus *Blastoceros*.

¹ *Natuurk. Tijdschr. Nederl. Ind.* ser. 2, vol. iv. p. 192 (1895).

² *Proc. Soc. Washington*, vol. xii. p. 99 (1898), published subsequently to *Deer of all Lands*.

³ *Op. cit.* pp. 100 and 101.

⁴ *Ibid.* p. 101.

⁵ *Ibid.* p. 102.

⁶ *Ibid.* p. 103.



WILD OXEN, SHEEP, AND GOATS OF ALL LANDS, LIVING AND EXTINCT

IN the *Deer of All Lands*, to which the present volume is intended as a companion, it has been stated that the family *Bovidæ*, or Hollow-horned Ruminants, form a group of the section *Pecora*, in which are also included the Prong-buck, or *Antilocapridæ*; the Giraffes, or *Giraffidæ*; and the Deer, or *Cervidæ*. And as the distinctive features of the *Pecora* have been mentioned in that volume, it is unnecessary that they should be recapitulated here.

All the existing wild members of the great family *Bovidæ* are readily characterised by the possession of a pair of bony appendages to the skull, clothed during life with hollow unbranched horns which are never shed, but grow continuously at the base, while their summits become more or less abraded and rounded by wear and tear. Although in many members of the family these appendages are confined to the males, in almost all of those forming the subject of the present volume they are developed in both sexes, although frequently much smaller in the females than in the males.

The presence of these unbranched horns thus suffices to distinguish the members of the family not only from the Deer and Giraffes, but likewise from the Prong-buck, in which the horns, although of the same

general nature, are forked and periodically shed from the underlying persistent bony cores.

This being so, and as only two sections of the family are treated of in the present volume, it would be superfluous to enter into the consideration of all the structural peculiarities of the *Bovidae* as a whole. The following points may, however, be noticed. In the first place, no members of the family, either living or extinct, possess upper canine teeth, or tusks, which are frequently so strongly developed in the Deer tribe (especially when antlers are wanting); and in this respect the Hollow-horned are clearly more specialised than the Antlered Ruminants. Very rarely do they show those tufts and glands on the lower part of the hind-legs which form such a characteristic feature in many of the Deer.

Further evidence of the specialisation or high grade of the family is afforded by the fact that the lower ends of the metacarpal and metatarsal bones, which persist in so many of the Deer, have invariably disappeared. Then, again, the lateral toes are very generally represented merely by the lateral hoofs, although in certain cases some small nodules of bone within them represent the skeleton of these portions of the limbs. Moreover, in some members of the family (although in none of those described here) even the lateral hoofs themselves have disappeared, and the main hoofs alone remain. In the liver the gall-bladder, which is found among the Deer tribe only in the Musk, is almost always present among the *Bovidae*.

The geographical distribution of the Hollow-horned Ruminants is very different to that of the Deer family. In place of being abundant in South America, and unknown in Africa south of the Sahara, they are wanting in the former area and extremely abundant in the latter; Ethiopian Africa and Central Asia being in fact their areas of maximum development. They also extend farther north than the Deer, and the only extensive land-areas from which they are absent are the Australasian region and South

and Central America, one extinct form having alone penetrated into the latter area.

That the Old World is the original home of the *Bovidae* may be considered as beyond dispute. And their paucity in North America (where they are now represented only by the American bison, the musk-ox, the big-horn, and the so-called Rocky Mountain goat) may not improbably be due to the circumstance that most of them are inhabitants of warm regions, and would consequently have been unable to cross what is now Bering Strait at the time when the Old and New Worlds were connected in that region. The few species that did succeed in crossing by this route are more or less exclusively cold-loving animals, which may account for the family never having succeeded in penetrating into the hot southern half of the New World.

Geologically speaking, the *Bovidae* appear to be a comparatively modern group. They are unknown in the strata where the earliest deer make their appearance. And although a few antelopes, which are the most generalised members of the family, are known from the Miocene deposits of Europe, the oxen, sheep, and goats were not developed, so far as we know, before the Pliocene period; and it is even doubtful whether sheep came into existence before the Plistocene period, although remains attributed to them have been reported from the Pliocene deposits of the Siwalik Hills in the North of India.

With regard to the members of the family forming the subject of the present volume, these constitute the sections or sub-families termed *Bovinae* and *Caprinae* by the scientific zoologist. As the general characteristics of these sub-families may be gleaned from those given as distinctive of the various genera, it will be unnecessary to define them in this place. A word must, however, be said with regard to the limitations of the term "goats," which occurs in the title of this volume, seeing that its technical and popular significations are not exactly the same. One of the four

North American representatives of the family *Bovidæ* is, indeed, commonly known as the Rocky Mountain goat, and might therefore seem entitled to a place among the animals described in this volume. Zoologically, however, it is not a goat in the proper sense of the term. It appears more nearly allied to the so-called goat-antelopes, of which the European chamois and the Oriental serows are familiar examples, and cannot therefore be included in the sub-family *Caprinæ*.

The various members of the extensive but somewhat ill-defined group of *Bovidæ* commonly known as antelopes are fully described and figured in the *Book of Antelopes* by Messrs. Sclater and Thomas. The present volume treats of the oxen, sheep, and goats; and the *Cervidæ* have already been described in the *Deer of All Lands*. To complete the *Pecora*, there accordingly remain the aforesaid goat-like antelopes among the *Bovidæ*, as well as the Prong-buck (*Antilocapridæ*), and the giraffes and their extinct allies (*Giraffidæ*). The groups remaining are therefore somewhat mixed, but it is to be hoped that some one will undertake the task of their description. And it is above all most important that the extinct forms should be included, as without them no adequate idea can be gained of the affinities and extent of the family last-named.

In the groups mentioned in the title, the present volume includes descriptions of all the named living species and races with which the writer is acquainted. But, as in the case of the deer, only such of the extinct forms as are represented by remains sufficiently well preserved to give a fair idea of their affinities are introduced into the text.

In addition to the attractiveness of the wild members of the groups under consideration on account of the magnificent horns which many of them carry, oxen, sheep, and goats must always claim special attention on account of their including the most important of the animals domesticated by man for the purpose of affording food. The domesticated species comprise (1) the common ox, (2) the humped ox, (3) the yak, (4) the

sheep, and (5) the goat, with their numerous breeds. Of the first, the wild ancestral stock, although well known, is now extinct. Of the second and fourth not only is the ancestral stock extinct, but it is also totally unknown; while of the third and fifth the original wild form still survives.

I. THE OXEN—GENUS BOS

Bos, Linn. *Syst. Nat.* ed. 12, vol. i. p. 98 (1766).

Characters.—Size generally large, but occasionally medium, or even small; build massive and stout; neck short and deep, and the head carried but little, if at all, above the level of the back; frequently a large dewlap to the throat. Extremity of muzzle large, broad, naked, and moist; no glands on the face or between the hoofs; four teats in the female; ears large, pointed, and often nearly naked, except on the margins; tail long, cylindrical, and frequently tufted at the tip, rarely long-haired throughout; main hoofs more or less pointed, and lateral hoofs well developed. Horns present in both sexes of the existing forms; generally not greatly larger in the males than in the females, but wanting in females of some extinct species; placed on or near the vertex of the skull and more or less separated at the bases; at first generally directed somewhat outwardly, then curving upwards, and sometimes also inwards at the tips; in section varying from cylindrical to triangular; externally either perfectly smooth, or marked with irregular transverse ridges and valleys; in colour varying from olive-green to black. Pelage either short and silky, or long and shaggy; generally no very marked difference, at least in colour, between summer and winter coat; general coloration usually uniform, but in some cases the lower portions of the legs, and rarely the buttocks, white, and in one or two instances a few white spots on the sides of the face. Upper molar teeth with very tall and squared crowns, on the inner side of which there is a slender cylindrical additional column of dentine

and enamel enclosed in the investing layer of cement. The bony cores of the horns are completely honeycombed with a number of large and irregularly shaped cavities. Skull without any pits or fissures below the eyes; the sockets of the eyes generally not prominent; the premaxillæ sometimes reaching the nasal bones. Canon-bones short and stout.

The group appears to be one of the most specialised and advanced of all the ruminants, as is indicated by the structure of the cheek-teeth, and its comparatively late appearance in time. Their nearest relatives are not easy to determine. The absence of horns in the females of some of the extinct species points to descent from a group in which a similar condition obtained. On the other hand, their molar teeth are very similar to those of the oryx and sable antelope group, and unlike those of all other ruminants. And as this character is not very likely to have originated independently, a relationship to that group is suggested. Such a connection is in harmony with the absence of face-glands in the group of antelopes in question, and the small size of the vacuities in the skull below the eyes. But, it may be urged, in these antelopes horns are developed in both sexes, and the muzzle is hairy. The latter difference is but of little importance, as it is quite probable that a naked muzzle is a feature of comparatively modern acquisition. With regard to the former, if there be any relationship between the two groups, the only explanation would seem to be that in the ancestral antelopes the females were hornless, and that the oxen branched off before horns were acquired by that sex.

Distribution.—Nearly all the habitable parts of the globe, with the exception of the Australasian and Neotropical regions, but represented in the New World only by the American bison and some nearly allied fossil forms. In time, dating in India from the Pliocene epoch, and represented in Europe in the latter portion of that epoch. The numerical abundance of species, both living and extinct, in the Old World, and especially Asia, points to the conclusion that the group originated in the

Eastern Hemisphere, and not improbably in Asia. Its immigration into Africa south of the Sahara was doubtless a comparatively modern event ; this being confirmed by the fact that all its representatives found in that continent appear to be modifications of a single specific type. Equally modern and equally limited was doubtless also the migration into America ; the route of this migration being clearly indicated by the fossil remains of the bison which occur in Alaska. This emigration may not unlikely have been contemporaneous with that of the wapiti, which, like the bison, has never succeeded in penetrating into the southern half of the New World.

Habits.—In the nature of their habitat oxen display a considerable amount of variability. Many prefer forest districts, especially where the ground is hilly and rocky, but the American bison was mainly an inhabitant of the open prairies, and the yak is still a denizen of the bleak highlands of Tibet. Probably, however, all the members of the group were originally forest-dwelling animals, some of which have been compelled by stress of circumstances to take to a life on open plains or plateaux ; and the fact that the American bison has a woodland race which is probably more primitive than its cousin of the prairies, affords a distinct confirmation of this hypothesis. All, or nearly all the species associate in herds of larger or smaller size, which may be protected and led by the bulls, and in some cases may be numbered in thousands ; but in many instances, at any rate, the oldest males separate themselves from the herds to pass a more or less completely solitary existence, and cows take the lead.

Of all ruminants, oxen are perhaps the most generally useful to mankind. Not only do they provide flesh of a highly nutritive and palatable nature, but the females furnish milk, and the skins of both sexes afford a most valuable supply of leather. The horns and hoofs, too, are largely used for several purposes ; while the American bison formerly supplied rugs or robes that afforded one of the most efficient protections against

extreme cold that is known. But this is by no means all, since in many parts of the world oxen are or were employed as beasts of burden or draught, which in some respects are superior even to the horse ; and were it not for the services of the yak, it would be almost an impossibility to traverse the high plateau of Tibet and some other districts of Central Asia. Several members of the group have been domesticated since very early times, two of these having no wild representatives now living.

By many writers the oxen are divided into several genera, although, as remarked by Mr. Blanford, such divisions seem scarcely worthy of that rank. Moreover, zoologists are by no means in accord as to the number of groups into which they should be divided. In the present work the groups adopted are given the rank of sub-genera only.

i. TYPICAL OR TAURINE GROUP—SUB-GENUS BOS

Taurus, H. Smith, in Griffith's *Animal Kingdom*, vol. v. p. 375 (1827), as a sub-genus.

Urus, H. Smith, *op. cit.* vol. iv. p. 417 (1827), as a sub-genus.

Zebus, Blyth, *Journ. As. Soc. Bengal*, vol. xxix. p. 282 (1860).

Characters.—Typically the horns quite or nearly cylindrical, situated far apart from one another on a ridge forming the extreme vertex of the skull, which overhangs the proper occipital surface of the latter ; forehead of skull flat and elongated, and a long interval between the bases of the horn-cores and the sockets of the eyes, which are not tubular ; nasal bones relatively elongated. Tail very long, reaching to below the hocks. Line of back nearly straight. Hair uniformly short, and legs apparently without white "stockings."

In the vertebral column the neural spine¹ of the seventh or last

¹ The neural spines are the tall vertical processes arising from the summits of the vertebræ and forming the ridge of the back ; the dorsal vertebræ are those to which the ribs are attached, the cervicals being those in front and the lumbar those immediately behind them.

cervical vertebra is short, the spines of the dorsal vertebræ are of moderate height and slope regularly and slightly away to the lumbar vertebræ, thus producing the straight line of the back. The upward production of the vertex of the skull so as completely to shut out the occipital surface in a front view, and the abbreviation of the parietal zone, indicate that the present and following groups are the most specialised of all the oxen ; but as regards the vertebræ the bison group is more advanced than the present one.

Distribution.—At the present day non-existent in a wild condition, but formerly ranging over the greater portion of the Eastern Holarctic and some part of the Oriental regions.

1. THE COMMON OX—BOS TAURUS

Bos taurus, Linn. *Syst. Nat.* ed. 12, vol. i. p. 98 (1766).

This species being extinct as a wild animal can only be very imperfectly described. There is no hump on the withers, the horns are perfectly cylindrical, strongly curved, and situated on the extreme summit of the occipital crest of the skull, the hinder surface of which is very tall, and without any distinct lateral notches. The cry is the well-known “low” of the domestic breeds.

The case of species named from domesticated breeds is always a difficult one as regards nomenclature ; and many writers refuse to adopt such name for the original wild race, whether living or extinct. After consultation with my friend Mr. O. Thomas, of the British Museum, I have, however, come to the conclusion that, in the cases of the extinct European ox and the living wild goat, it is preferable to retain the names originally given to the domesticated breeds.

a. EUROPEAN WILD RACE, OR AUROCHS—*BOS TAURUS PRIMIGENIUS*
(*Extinct*)

Bos primigenius, Bojanus, *Nova Acta Acad. Cæs. Leop.-Car.* vol. xiii. pt. 2, p. 422 (1827); Owen, *Brit. Foss. Mamm.* p. 498 (1846); Wilckens, *Biol. Centralblatt*, vol. v. p. 111 (1885); Nehring, *Landwirtsch. Jahrb.* vol. xxv. p. 915 (1896); Schiemenz, *Biol. Centralblatt*, vol. xvii. p. 793 (1897).

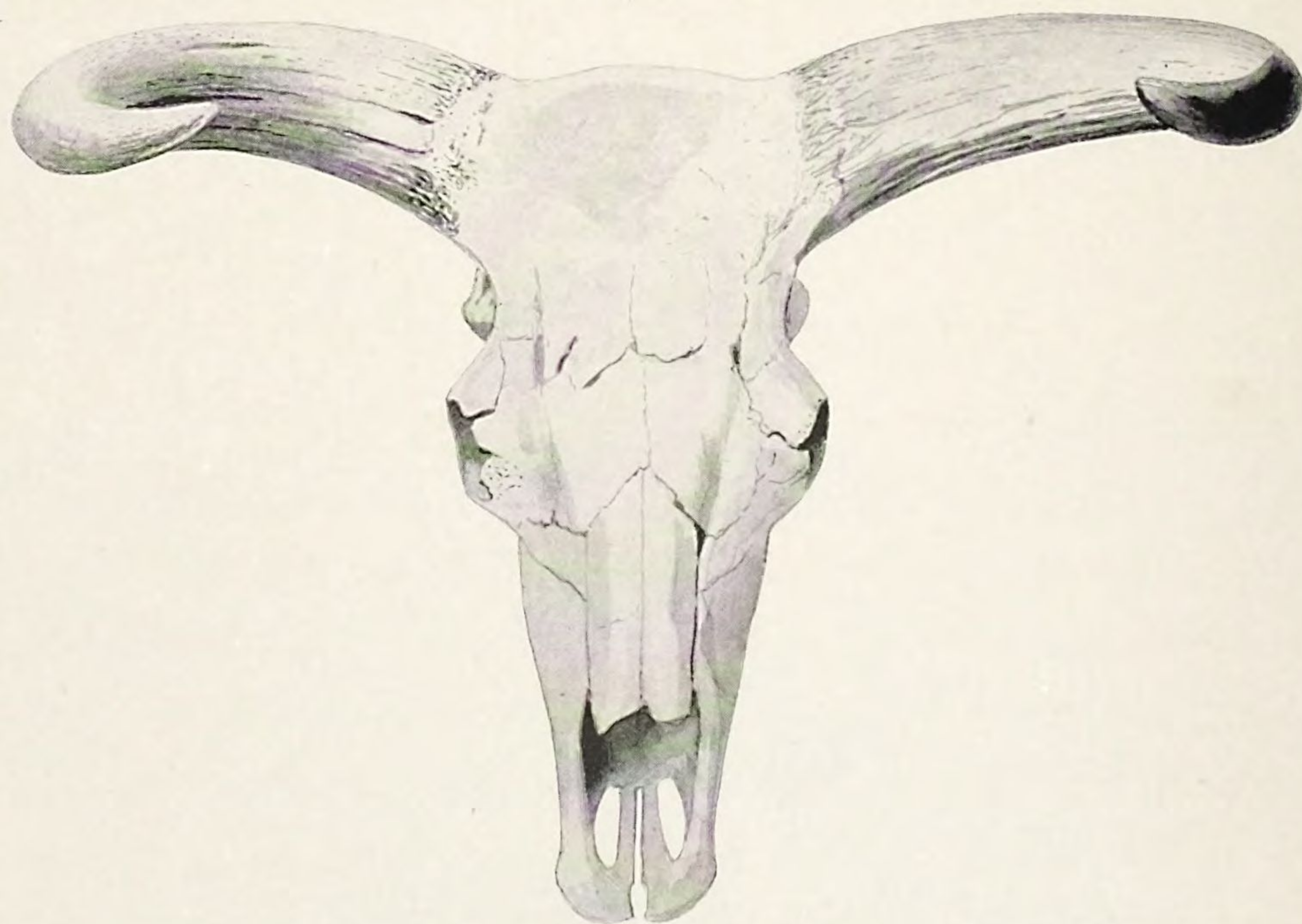


FIG. 1.—Restored skull of the Aurochs. From a specimen in the British Museum from the brick-earth of Ilford, Essex.

Bos (Taurus) urus, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 414, v. p. 376 (1827).

Bos urus, Fleming, *Brit. Animals*, p. 24 (1828); Dawkins, *Quart. Journ. Geol. Soc.* vol. xxii. p. 391 (1866).

Bos latifrons, Fischer, *Bull. Soc. Moscou*, vol. ii. art. 2 (1830), *Mém. Acad. Moscou*, vol. iii. p. 281 (1834), *nec* Harlan, 1815.

Bos taurus priscus, *Bos fossilis*, *Urus fossilis*, *Urus colossus*, and *Bos cæsaris*, Keferstein, *Naturgeschichte*, vol. ii. p. 193 (1834).

Bos taurus giganteus, Owen, *Brit. Foss. Mamm.* p. 502 (1846).

Bos giganteus, Davies, *Cat. Brady Coll.* p. 47 (1874).

Bos taurus primigenius, Lydekker, *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 2 (1885).

History.—Although the wild ox of Europe was originally known as the aurochs, or ur, latinised into *urus*, after its extinction these names became transferred to the bison, as the only surviving European representative of the tribe. Much uncertainty long prevailed with regard to the date when this wild bull ceased to exist in its original condition in the forests of the Continent. Its remains occur abundantly in the later Plistocene deposits of Britain, those from the brick-earth of Ilford, in Essex, being remarkable for their fine state of preservation, and showing well the enormous dimensions attained by this magnificent animal. Similar remains are met with in many British caverns, and also in the fens of Cambridgeshire and Lincolnshire; these latter peat-deposits belonging to the prehistoric period. Other remains indicate that the range of the animal extended southwards into North Africa and eastwards into Western and Northern Asia. The question as to the date of its survival in the wild state in Europe has been taken up by Dr. A. Nehring of Berlin, and still later by Dr. P. Schiemenz. The most important evidence is afforded by one Herberstain, who lived from 1486 to 1566, and in 1550 published a work under the title of *Moscovia*.¹ This work contains figures of two quite distinct types of wild European cattle, one of which is clearly the bison, and the other the aurochs, or ur; and it is important to notice that Herberstain had no hesitation in referring the latter names to the wild ox as distinct from the bison. Herberstain himself appears to have

¹ Herberstain (Sigism. Baro), *Commentari della Moscovia et parimente della Russia, tradotti novamente di latino in lingua Italiana*, sm. 4to, woodcut map and 6 woodcuts, Venet. G. B. Pedrezzano, 1550.

travelled frequently in Poland, and the figures of the two animals may be regarded as having been executed under his own immediate supervision. It has indeed been urged that the portrait of the aurochs is that of a domestic bullock, but Messrs. Nehring and Schiemenz have conclusively shown that this is not the case, and that the original of the picture was a wild Polish aurochs. In Herberstein's time, that is to say at least as late as the middle of the sixteenth century, the aurochs was preserved in a single Polish forest, as is the bison at the present day in another. The forest in question is that of Jaktorowka, situated about fifty-five kilometres to the west-south-west of Warsaw in the districts of Bolechow and Sochaczew. Other evidence is to the effect that the last survivor of the herd in this forest was slain in the year 1627. Regarding its survival in other districts, a skull preserved for centuries in the castle of Bromberg, Prussia, which shows three spear-wounds on the forehead, is stated to afford decisive evidence that the aurochs lived on in that part of the country at least as late as the twelfth or thirteenth century. It is further evident that, like its cousin the bison, the aurochs was a forest-dwelling animal.

Such being the case, it may be taken as practically certain that several of the breeds of European cattle are the immediate descendants of the aurochs. Calves of the latter were probably caught and tamed by the early inhabitants of Europe, and their progeny gave birth to some at least of the present European breeds, for which there is accordingly no need to seek an Eastern origin. That the domesticated breed would become smaller than the wild ancestral race is only what might naturally be expected; a precisely analogous instance occurring in the yak, of which the race domesticated in the Bhutan and Darjiling districts bear no comparison to the wild animal, or even to the semi-domesticated breed kept by the nomads of the Rupshu plateau.

Although otherwise white, the half-wild Chillingham cattle usually

have the muzzle and the inside of the ears reddish, whereas in the Cadzow breed the same parts are black. In other European breeds various shades of dun, fawn, and red, as well as black, are commonly met with; and as red or fawn is a less specialised type of coloration than black, it might well have been thought that one of these was the predominant tint of the aurochs. According, however, to the authors already referred to, Herberstain's woodcut and another ancient picture show that the ancient wild ox of Europe was black. If this is to be depended on, the reds and duns of our domesticated breeds must apparently be regarded as a reversion to the coloration of some older race.

Like the bison, the aurochs is known to have been common in the Black Forest in the time of Julius Cæsar; and was of course still more widely spread in earlier years. In Britain its remains, as already mentioned, occur in deposits as late as those of the fen districts, but none have hitherto been identified in those dating from or subsequent to the time of the Roman occupation, when it would accordingly appear to have become exterminated in England.

Little more can be added with regard to the characteristics of the wild aurochs, except that it must have been a huge animal, probably standing at least six feet high at the shoulders, and with horns not very unlike those of the modern Chillingham cattle, only very much larger. The horns usually have an outward and forward curvature at first, after which they bend somewhat upwards and inwards. The following are the dimensions of the horn-cores of some of the splendid specimens collected by the late Sir A. Brady from the brick-earth of Ilford, and now in the British Museum :—

Museum Number.	Length along Outer Curve.	Basal Circumference.	Tip to Tip.
45,424	36	17	28
45,425	?	16.5	?
45,426	38	17.5	30
45,427	38	19	34

Museum Number.	Length along Outer Curve.	Basal Circumference.	Tip to Tip.
45,428	33	17	32
45,429	38	18.5	40
45,430	36	18	25
45,431	34	18	32
45,432	31	18	33
45,433	32	15	34

To obtain an idea of the full dimensions, allowance must be made for the horny sheaths, which, of course, have perished.

Distribution.—During the Plistocene period nearly the whole of Europe, ranging from the British Islands to the south of Russia, and from Scandinavia to Spain and Italy ; probably also extending into Western Asia. In many parts of Central and Eastern Europe the species survived as a wild animal till a comparatively late date in the historic period.

b. NORTH AFRICAN WILD RACE—*BOS TAURUS MAURITANICUS* (*Extinct*)

Bos primigenius mauritanicus, P. Thomas, *Bull. Soc. Zool. France*, 1881, p. 36, pl. iii.

Bos opisthonomus, Pomel, *Carte Géol. Algérie, Mon. Pal.*—*Les Bœufs*, p. 16 (1894).

Characters.—Nearly allied to the European wild race, but with the forehead shorter, the horn-cores curving less forwards and more downwards, and the limbs relatively longer and more slender.

The *Bos opisthonomus* of M. Pomel, which is practically admitted by its describer as identical with the *B. primigenius mauritanicus* of Mr. P. Thomas, is regarded by the former writer as entitled to rank as a distinct species ; but there can be little hesitation in classing it as a variety of the common ox.

Distribution.—Northern Africa in the districts of Algeria and Tunis,

probably during the Plistocene epoch, but perhaps surviving into the early historic period.

c. DOMESTICATED BREEDS—*BOS TAURUS TYPICUS*

Urus scoticus, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 417 (1827).

Bos scoticus, Swainson, *Classif. Quadrupeds*, p. 285 (1835).

Bos longifrons, Owen, *Rep. Brit. Assoc.* for 1843, p. 234 (1844).

Bos frontosus, Nilsson, *Ann. Mag. Nat. Hist.* ser. 2, vol. iv. p. 349 (1849).

Bos taurus, var. *scoticus*, Bell and Alston, *Brit. Quadrupeds*, p. 368 (1874).

Bos taurus, var. *longifrons*, Lydekker, *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 16 (1885).

The domesticated breeds of cattle form, as already mentioned, not only the type of the species *Bos taurus*, but likewise of the genus *Bos* itself, and therefore of the family *Bovidæ*. Although, as implied by its title, the present volume does not profess to treat of domesticated animals, a few words are advisable in this place on account of the widely spread idea that the half-wild cattle of Chillingham and some other British parks are aboriginally wild animals. This, however, may be confidently stated to be an erroneous idea ; and although they may have existed in their present condition for a very long period, it is practically certain they are descended from a domesticated or semi-domesticated breed, possibly not very distantly removed from the wild aurochs. Consequently, they have no right to the specific name *scoticus*, which has been given them. The same remark applies to the names *longifrons* and *frontosus*, which have been applied to a small breed from the peat of the fens and other superficial deposits commonly known as the Celtic short-horn, and which undoubtedly appears to have been a domestic animal.

There being no other primitive wild ox in Europe, and an Eastern derivation in the highest degree improbable, it is evident that all the domesticated breeds of European cattle must trace their ultimate ancestry to the aurochs. It may, indeed, be admitted that some of the breeds—especially those of Eastern Europe—may have crossed with African or Indian humped cattle, but this does not affect the general proposition.

Taking the aurochs as the ultimate ancestor of all European domesticated cattle, the question narrows itself as to whether any of the British breeds can be regarded as its direct descendants. Some writers have taken the view that the British white park-cattle were derived directly from the aurochs. Not so Owen, who believed that the latter died out as a wild race in Britain, and that the park-cattle are derived from the domesticated, and, apparently, imported race. That this view is probably correct, so far as the intervention of a domesticated breed is concerned, may be admitted.

Now we come to a much more difficult part of the question, and one in regard to which much misapprehension has arisen. Professor T. M'Kenny Hughes, in a paper published in the *Archæologia* for 1896, expresses the opinion that the British park-cattle are descended from a breed imported into the country during the Roman occupation. And he remarks that "in England no bones which could possibly be referred to the *Urus* have been proved to have been found with Roman or later remains, and no evidence has been obtained of its ever having been domesticated in this country." If this statement be correct—and if it be also admitted that the aurochs is the ultimate ancestor of all European cattle—it is obvious that all the British breeds must be of continental origin. But, as Professor Hughes remarks, "Cæsar mentions that there were large herds of domesticated cattle in Britain, and we know from numerous excavations into Roman and Roman-British rubbish-pits that these belonged, not to the *Urus*, but to *Bos longifrons*. This, then, is the native breed with which we

must start in all our speculations as to the origin and development of British oxen. The Romans found that breed here, and no other."

We have next to inquire what was the origin of this so-called *Bos longifrons*, or Celtic short-horn, as it is often called? On this subject Professor Hughes writes that "before the *Urus* had disappeared the native short-horn *Bos brachycerus*, or *longifrons*, had arrived in Britain." Doubtless it had, but whence came it, and what was its parent form? Professor Rüttimeyer considered that the Celtic short-horn was a stunted form of the aurochs, and that it existed only as a domestic race. On the other hand, Professor Hughes observes: "It is difficult to believe that all the scattered and associated bones of *Bos longifrons* which we find in the fens along with the remains of the beaver, the wolf, and the red deer, are those of domestic animals. They may, of course, be those of domestic cattle run wild; but if *Bos longifrons* was not indigenous, it must have been introduced by man into this country at a very remote period. At any rate, from its presence in such great numbers in pre-Roman and Roman times, as proved by excavations, we must admit a strong probability that some of our recent domestic breeds must have been derived from it." The latter sentence may be accepted as perfectly true; but where, it may be asked, is the Celtic short-horn—whether a wild or a domesticated animal—supposed to have come from? If not separately created, it must assuredly have originated from the aurochs, for there is no other earlier form to which its pedigree can probably be traced. The great fallacy in all the above is, of course, the recognition of the Celtic short-horn as a distinct species. It is, and can be, nothing but a variety of *Bos taurus*, and Rüttimeyer's idea that it is a stunted domesticated race of the aurochs is almost certainly true. And it thus seems impossible to accept the statement that, if the aurochs "has left its mark in any domestic cattle in the British Isles, it can only be through the long-horned German cattle."

In the memoir cited much stress is laid on the difference in the curva-

ture and direction of the horns between the aurochs on the one hand, and the Celtic short-horn and park-cattle on the other. When, however, we admit—as we must—that both the two latter (in common with other European cattle) are the ultimate, if not the proximate, descendants of the former, this is really begging the whole question. Apart from this, every breeder knows how easily the form of the horns of cattle is altered; and the more upward direction of the horns of the Chillingham Park cattle, as compared with those of the aurochs, is quite what might be expected to occur when the massive horns of the original wild race became lightened by partial or complete domestication.

That a certain similarity in the direction of their cranial appendages is sufficient to indicate that the Chillingham cattle are wholly derived from an Italian breed introduced into Britain by the Roman invaders, does not appear a warrantable supposition, although it is quite possible that some Italian cattle may have been imported to improve the original British breed. In Scotland and the north of England there is not the decisive evidence that the aurochs was exterminated at such an early date as in the south, and it has yet to be demonstrated that the park-breeds are not the immediate descendants of a partially domesticated race of the former. With regard to the Celtic short-horn, all the available evidence points to the conclusion that it belongs to a thoroughly domesticated race derived from the wild aurochs at a very remote epoch. Indeed, the occurrence of remains of an apparently similar breed in the prehistoric lake-dwellings of Switzerland suggests that the breed may have been established prior to the separation of Britain from the Continent.

2. THE NARBADA OX—*BOS NAMADICUS* (*Extinct*)

Bos namadicus, Falconer, *Cat. Foss. Vert. As. Soc. Bengal*, p. 232 (1859), *Pal. Mem.* vol. i. p. 280, pl. xxii. (1868); Lydekker, *Pal. Ind.* (*Mem. Geol.*

Surv. Ind.), ser. 10, vol. i. p. 95, pl. xi. (1878), *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 22 (1885); Rütimeyer, *Abh. schweiz. pal. Ges.* vol. v. p. 176 (1878).

Bos (Urus) namadicus, Falconer, *Quart. Journ. Geol. Soc.* vol. xxi. p. 381 (1865).

Characters.—Typically very closely allied to the European wild ox, of which Rütimeyer suggested it was only a local race, but in some instances the horn-cores more or less flattened at the base, and thus approximating to the bibovine type. From this feature I was formerly led to hazard the conjecture that the Narbada ox was the ancestor of the latter group, but it is extremely doubtful whether such a view can be maintained, although there is probably a near relationship between the two.

Distribution.—Southern India during the Plistocene epoch. Remains of this species have been found in association with chipped stone implements. The dying out of this taurine ox and its replacement by the bibovine group would appear a most extraordinary feature, were it not for the circumstance that the latter appears to be represented in the Narbada deposits.

3. THE ZEBU, OR HUMPED OX—*BOS INDICUS*

Bos indicus, Linn. *Syst. Nat.* ed. 12, vol. i. p. 99 (1766); Blanford, *Fauna Brit. Ind.—Mamm.* p. 483 (1891).

Bos pusio, Swainson, *Classif. Quadrupeds*, p. 283 (1835).

Bos dante, Gray, *Cat. Ungulata Brit. Mus.* p. 22 (1852), *Cat. Ruminants Brit. Mus.* p. 9 (1872).

Zebus gibbosus, Blyth, *Journ. As. Soc. Bengal*, vol. xxix. p. 282 (1860).

Bibos indicus, Rütimeyer, *Denkschr. schweiz. Ges.* vol. xxii. art. 3, p. 170 (1867), *Abh. schweiz. pal. Ges.* vol. v. p. 189 (1878).

Bos zebu, Blanford, *Zool. Abyssinia*, p. 272 (1870).

Characters.—Distinguished from the common ox by the presence of a distinct hump on the withers, by the conformation of the skull, and the curvature of the horns, by the large and drooping ears, the enormous dewlap, and the grunting cry. The presence of a white ring round each fetlock is also very characteristic of this ox. Moreover, humped cattle seldom seek the shelter of shade, and never stand knee-deep in water like the domesticated European breeds.

Although in the Indian breeds the horns are in most cases of comparatively small size, in the Galla breed of Africa they attain enormous proportions. Nothing is known as to the ancestry or original habitat of humped cattle. Mr. Blyth was, indeed, of opinion that they originally came from Africa, but there is nothing definite in favour of such a view.

Distribution.—Known only in the domesticated state from India, Burma, China, Siam, Africa, and Madagascar. Properly speaking, therefore, the species does not come within the scope of the present volume, but since it is important that its right to distinction should be recognised, it has been thought better to give the above brief notice. It may be added that the origin of the name *zebu* is quite unknown, it being foreign to all the native languages of India.

4. THE SIWALIK OX—*BOS ACUTIFRONS* (*Extinct*)

Bos acutifrons, Lydekker, *Rec. Geol. Surv. India*, vol. x. p. 30 (1877), *Pal. Ind. (Mem. Geol. Surv. Ind.)*, ser. 10, vol. i. pp. 112 and 173, pls. xii. and xiii. (1878).

Characters.—A magnificent species differing from other members of the present group by the convexity of the forehead, the shorter interval between the bases of the horn-cores and the sockets of the eyes, the curvature and pyriform section of the enormous horn-cores, which are set closer together on the forehead, and the form of the occiput.

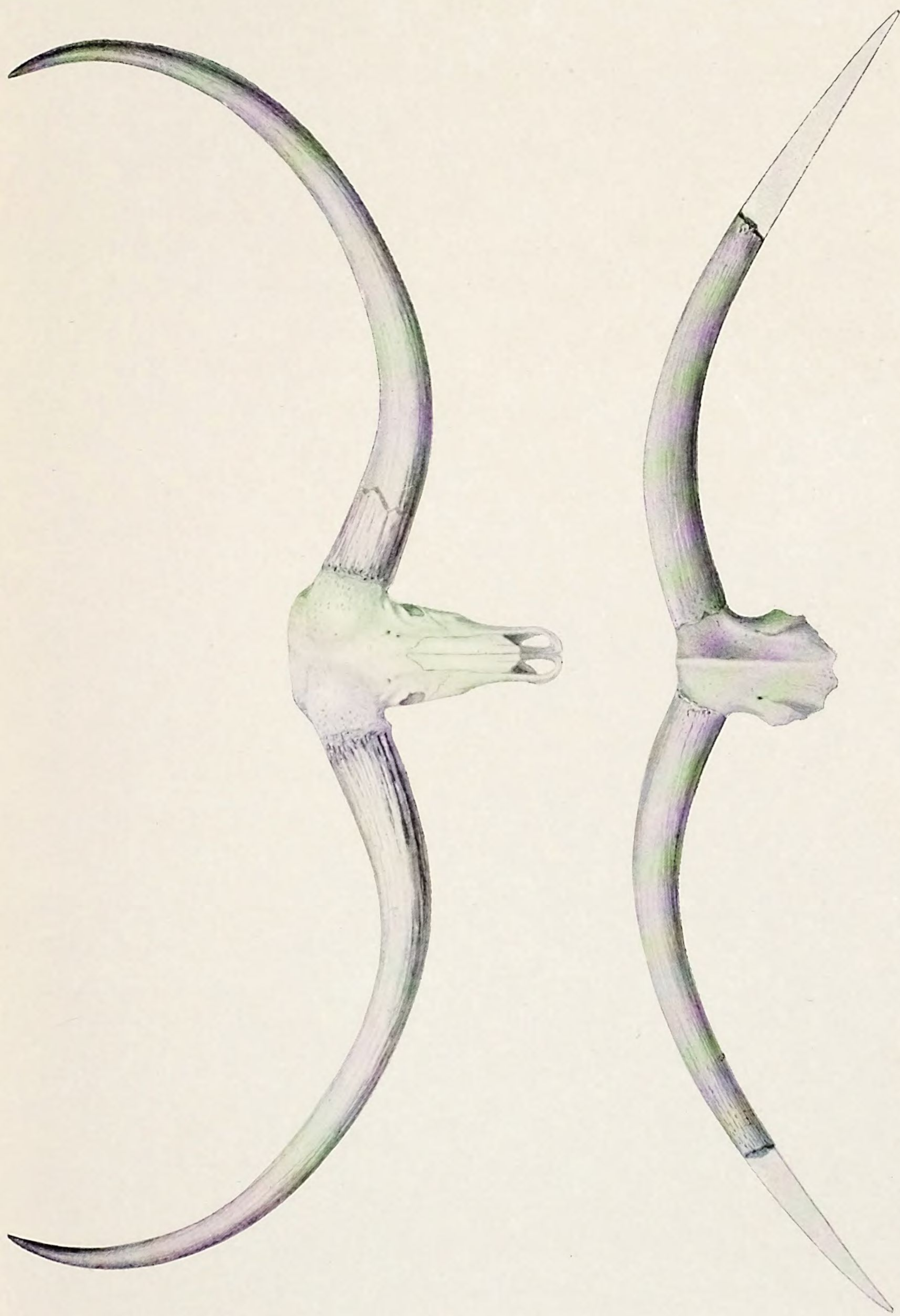


FIG. 2.—Skulls of Algerian Buffalo (upper figure) and Siwalik Ox (lower figure).

In its present broken condition the span of the horn-cores of the type specimen (Fig. 2) is considerably over six feet, from which it may be inferred that in life they were little, if at all, short of ten or eleven feet from tip to tip.

Distribution.—Northern India during the Pliocene period. Not improbably the skull from the same deposits described by myself as *Bos planifrons* may indicate the female of this species.

ii. BIBOVINE GROUP—SUB-GENUS BIBOS

Bibos, Hodgson, *Journ. As. Soc. Bengal*, vol. vi. p. 499 (1837).

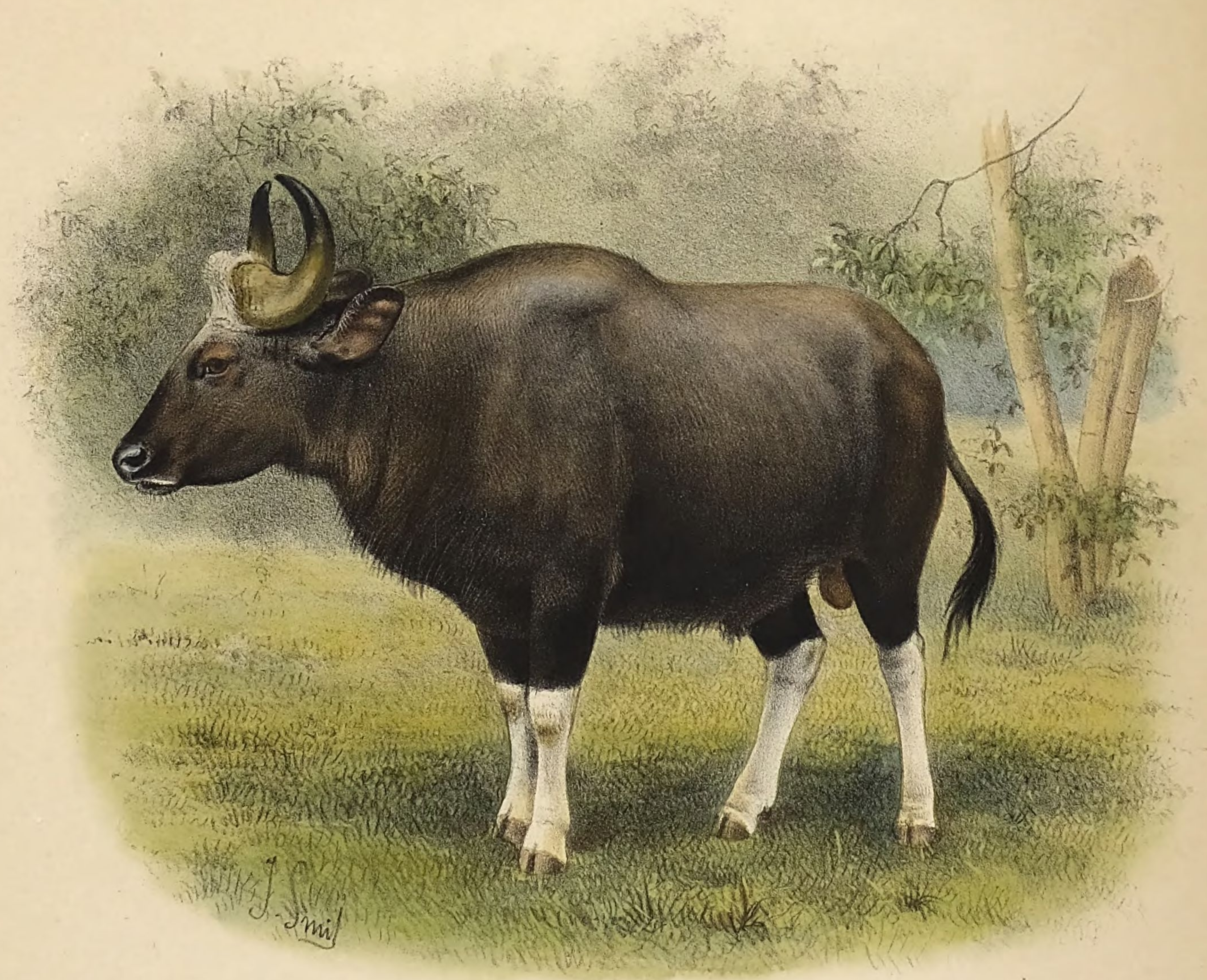
Gavæus, Hodgson, *op. cit.* vol. xvi. p. 706 (1847).

Syncerus, Hodgson, *loc. cit.* 1847, *nec Syncera*, Gray, 1821.

Characters.—Allied to the typical group, but the forehead shorter, the interval between the bases of the horns and the sockets of the eyes less, the horns generally more or less elliptical in section, especially at their bases in old bulls, the tail relatively shorter, reaching but little, if at all, below the hocks, and a more or less distinct elevated ridge extending from the nape and shoulders to the middle of the back, where it suddenly terminates, frequently forming a step of several inches in height. Colour of adult bulls generally dark blackish-brown, with the legs from above the knees and hocks to the hoofs white or whitish; females and young males either of a paler colour, or reddish-brown, with the same white legs. Hair short, fine, and glossy, without tendency to form a mane on any part of the head or body. Hoofs narrow and pointed. Thirteen pairs of ribs.

The ridge on the back, which attains a much smaller development in the banting than in the other two species, is due to the enormous elevation of the neural spines¹ of the dorsal vertebræ, the summits of which form a nearly horizontal line from the third to the eleventh of the series, and then

¹ See note on p. 8.



GAUR.

make a sudden drop to the thirteenth and the lumbar, the twelfth dorsal being included in the side of this drop. Although the horns, as in the typical group, are situated on its extreme vertex, the skull exhibits certain differences of conformation on its hinder, or occipital aspect, by means of which it may readily be distinguished from that of the latter.

Distribution.—The Oriental region.

I. THE GAUR—*BOS GAURUS*

Bos gaurus, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 399 (1827); Evans, *Journ. As. Soc. Bengal*, vol. vi. p. 223, pl. xvi. (1837); Elliot, *ibid.* x. p. 572 (1841); Blyth, *ibid.* xi. p. 444 (1842), xxi. p. 433 (1852), xxxi. p. 336 (1862); MacMaster, *Notes on Jerdon*, p. 128 (1870); Flower and Garson, *Cat. Osteol. Mus. Coll. Surgeons*, pt. ii. p. 227 (1884); Blanford, *Proc. Zool. Soc.* 1890, p. 592, *Fauna Brit. India—Mamm.* p. 484 (1891); W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 124 (1891); Huet, *Bull. Soc. Acclim. Paris*, vol. xxxviii. p. 12 (1891); Ward, *Records of Big Game*, p. 270 (1896); Pollok, *Zoologist*, ser. 4, vol. ii. p. 2 (1898).

Bos (Bison) gaurus, H. Smith, in Griffith's *Animal Kingdom*, vol. v. p. 373 (1827).

Bos gour, Hardwicke, *Zool. Journ.* vol. iii. p. 233 (1828); Cantor, *Journ. As. Soc. Bengal*, vol. xv. p. 272 (1846).

Bos gayæus, Hardwicke, *loc. cit.* (1828).

Bison gaurus, Jardine, *Naturalist's Library—Mamm.* vol. iv. p. 251 (1836).

Bibos subhemachelus, Hodgson, *Journ. As. Soc. Bengal*, vol. vi. p. 499 (1837).

Bibos cavifrons, Hodgson, *Journ. As. Soc. Bengal*, vol. vi. p. 745 (1837),

x. p. 449 (1841), xvi. p. 706 (1847); Elliot, *Madras Journ.* vol. x. p. 227, pls. v. and vi. (1839); Horsfield, *Cat. E. Ind. Mus.* p. 181 (1851).

Bos gaur, Sundevall, *K. Svenska Vet. Ak. Handl.* for 1844, p. 152 (1846).

Bibos gaurus, Gray, *Cat. Hodgson Coll.* p. 24 (1846), *Cat. Ungulata Brit.*



FIG. 3.—Head of Bull Gaur. After Forsyth, *Highlands of Central India*.

Mus. p. 32 (1852), *Cat. Ruminants Brit. Mus.* p. 13 (1872); Rütimeyer, *Denkschr. schweiz. Ges.* vol. xxii. art. 3, p. 170 (1867), *Abh. schweiz. pal. Ges.* vol. v. p. 189 (1878); Davison, *Proc. Zool. Soc.* 1889, p. 447.

Bibos asseel, Horsfield, *Cat. E. Ind. Mus.* p. 181 (1851).

Gavæus gaurus, Blyth, *Journ. As. Soc. Bengal*, vol. xxix. p. 282 (1860); Jerdon, *Mamm. Ind.* p. 301 (1867); Sterndale, *Mamm. Ind.* p. 481 (1884).

Plate I.

Characters.—Build massive (the body being deep and the limbs relatively short) and size large, the height in old bulls occasionally reaching as much as six feet four inches (nineteen hands) at the shoulder. Ears large. The ridge on the back strongly developed, and ending in a sudden descent about midway between the shoulders and the tail. Skull with a high ridge on the vertex, forming a bold arch between the bases of the horns, and beneath it the profile of the forehead deeply concave. Horns markedly flattened at the base, strongly curved throughout their length, with the tips inclining inwards and somewhat backwards; their colour pale greenish or yellowish, with black tips. Tail just reaching the hocks. Generally little or no distinct dewlap. Hair short, and becoming very sparse on the back in old bulls; general colour of the upper-parts in old bulls dark olive-brown tending to become almost black; under-parts paler, but golden-brown at the insertion of the limbs; upper portion of forehead to the nape of the neck ashy-gray, passing in some cases into whitey-brown or dirty white; legs from above the knees and hocks downwards pure white; muzzle pale-coloured. In cows and young bulls the general coloration rather less dark, and in some cases, especially during winter and in individuals inhabiting comparatively dry and open districts, tending to rufous; calves are stated to have a dark streak down the back.

Although a bull from the Malay Peninsula was exhibited in the London Zoological Gardens in 1889, I have never seen a living gaur, and my descriptions are consequently derived from museum specimens and the writings of others. The British Museum possesses a fine mounted male and female from India, but additional specimens are necessary before several disputed points in connection with this magnificent species can be decided. With regard to size, Mr. Blanford, in 1891, wrote as follows:—

“Large bulls are said to exceed 6 feet in height at the shoulder, but this is rare and exceptional, 5 feet 8 inches to 5 feet 10 inches being the usual height. Cows are much smaller, about 5 feet high. A huge bull, measured by Elliot, was 6 feet $1\frac{1}{2}$ inches high, 9 feet 6 inches from nose to root of tail, tail 2 feet 10 inches long, girth behind shoulder 8 feet. A cow 4 feet $10\frac{1}{2}$ inches high measured 7 feet from nose to rump over curves, and 6 feet 9 inches in girth.”

The greatest shoulder-height recorded by Mr. Rowland Ward is 6 feet 4 inches, in a specimen killed by Lord Powerscourt; a bull shot by the Maharaja of Kuch Behar coming next, with a height of 6 feet $3\frac{1}{2}$ inches. Three other bulls measuring over 6 feet are also recorded; one of these having been measured with extreme accuracy. Colonel Pollok, who states that the gaur from the eastern side of the Bay of Bengal are larger than those from India, records an Indian bull standing 6 feet $4\frac{1}{2}$ inches (19 hands $\frac{1}{2}$ inch) at the shoulder, a Burmese bull 6 feet $7\frac{1}{2}$ inches (19 hands $3\frac{1}{2}$ inches), and a Burmese cow 6 feet 4 inches (19 hands). If accurate, these latter dimensions are the largest on record, and bear out the statement as to the superior size of the eastern form of the species.

With regard to the question whether the Burmese and Malayan animals should be regarded as indicating a race apart from the typical Indian form, the following observations may be quoted. Mr. Blanford, for instance, states that skulls from the Duars of Bhutan, the Mishmi Hills, and the Malay Peninsula are much broader in proportion across the forehead than those from the Indian Peninsula; adding that he is uncertain whether this broad-headed form is alone found to the east of the Bay of Bengal, although inclining to the opinion that it is not. He likewise mentions that in a skull from the Mishmi Hills in the collection of Mr. Hume the frontal concavity is wanting, thus approximating to the gayal type. And, if my recollection serves me right, there are one or more skulls in the

Indian Museum, Calcutta, from the districts north or east of the Bay of Bengal, exhibiting a similar conformation of the forehead.

Colonel Pollok writes as follows on this point :—"Not only does the Burmese gaur stand higher, but the dorsal ridge extends further back, to within a span of the croup, the dent in the forehead is deeper, the cylindric crest higher, the horns larger, heavier, and more truncated, and but seldom worn at the tips as in the Indian." He adds, however, that even in India gaur are variable, and that those from the Western Ghats are larger, with a profile more like a ram, than those from the Wynad district, thereby resembling their Burmese brethren. Further, in the young Malayan bull, formerly living in the London Zoological Gardens and figured by Mr. Blanford in the Society's *Proceedings* for 1890, the dorsal ridge is represented as terminating in the middle of the back.

Although a larger series of specimens may ultimately enable such division to be made, the evidence at present available is insufficient to admit of the gaur from the eastern portion of the animal's range—the *sladang* of the Malays—being separated as a race distinct from the western form. With regard to the abnormal skulls from the Mishmi Hills and neighbourhood, I have no suggestion to offer, unless it be that they indicate a strain of gayal blood.

Another question relates to the absence or presence of a dewlap. Mr. Blanford states that no distinct dewlap is developed ; and it is certainly wanting in the British Museum specimens. On the other hand, a Travancore planter quoted by Colonel Pollok writes that while some of the gaur in that district have little or no dewlap, in others that appendage is well developed, and may form a fold of skin depending several inches from the neck. So marked indeed is the difference that the natives divide the gaur into two races, according to the presence or absence of the appendage in question.

The observation recorded above that female and young gaur inhabiting

drier and more open districts than usual tend to a reddish tint, is of great interest in connection with the theory that blackness in animals (as mentioned in *The Deer of All Lands*) is correlated with dampness and heat.

The following are some of the largest dimensions of gaur horns recorded by Mr. Rowland Ward :—

Length on Outer Curve.	Basal Circumference.	Tip to Tip.	Widest Inside.	Locality.
$34\frac{3}{4}$	20	25	$40\frac{1}{2}$ (outside)	Vardi Mallay
$33\frac{3}{4}$	$17\frac{1}{4}$	24	?	?
$33\frac{1}{2}$	$18\frac{1}{2}$	38	?	Mysore
$33\frac{1}{2}$	$18\frac{1}{2}$	25	$33\frac{1}{4}$	Travancore
$33\frac{1}{8}$	18	$23\frac{1}{2}$	$34\frac{1}{2}$	Kuch Behar
33	$17\frac{1}{2}$	$20\frac{1}{2}$	$32\frac{1}{4}$	?
$32\frac{1}{2}$	?	27	?	Western Ghats
$31\frac{7}{8}$	$17\frac{1}{8}$	$21\frac{3}{8}$	$32\frac{1}{2}$	?
$31\frac{1}{2}$	18	29	43 (outside)	?
$31\frac{1}{2}$	17	21	$32\frac{1}{4}$	?
$31\frac{1}{4}$	$16\frac{3}{8}$	$12\frac{5}{8}$	$27\frac{1}{2}$	?
$30\frac{1}{2}$	$19\frac{1}{2}$	16	35 (outside)	Travancore
$30\frac{1}{4}$	$18\frac{1}{2}$	$22\frac{1}{2}$	$37\frac{1}{4}$	„
30	$19\frac{1}{4}$	11	$32\frac{1}{8}$	Kuch Behar
30	16	38	41 (outside)	Central Provinces

Distribution.—The larger hilly forest districts of the Indian Peninsula, Burma, the Malay Peninsula, and probably Cochin China and Siam, but the eastern limits not yet accurately defined. Unknown in the Malay Islands and Ceylon, although stated to have formerly occurred in the latter island, where, however, it may have been introduced. Regarding the distribution in India, Mr. Blanford writes as follows :—“In India at present its extreme north-western habitat is probably the Rajpipla Hills, near Broach ; and west of longitude 80° east the river Narbada forms approximately, though not absolutely, the northern boundary of its range. It does not inhabit the grass jungles of the Gangetic plain, except close to the Himalayas ; but it is found in the forests at the foot of those mountains,

as far west as Nepal. South of the Ganges it exists in suitable tracts in Chutia-Nagpur, Orissa, and the Northern Circars, the Central Provinces, Hyderabad territories, Mysore, and throughout the Western Ghats, wherever it has not been exterminated or driven away."

Habits.—All who have had the opportunity of seeing gaur in their native wilds describe them as displaying marvellous activity in getting over the hilly ground on which they are generally found. Although they nearly always keep to forest or high grass, they are sometimes found away from hills. In the south of India their favourite haunts are rocky hills, with open grassy tablelands at the summit; and here they are found at elevations of from 2500 to 5000, or even 6000 feet above sea-level, although in the Terai districts of the Himalaya they never ascend nearly so high. Usually they go about in small parties or herds numbering from five or six to about twenty head, but occasionally more may be seen together. The old bulls, which, as Colonel Pollok remarks, are so short-haired as to look almost as though they had been shaved, keep much to themselves, and in some instances are solitary; and even young bulls may be seen alone, or in parties of two or three. Although grass, especially that which springs up after the periodical jungle-fires, forms their staple food in most districts, at certain seasons of the year they browse largely on the young and succulent shoots of the bamboo, which, after all, is only grass of a larger kind. Feeding at morning and evening, they retire during the heat of the day to the depths of the forests, or to thick grass-brakes, where they escape the torments of gadflies. The early evening or afternoon appears to be the general time for drinking. Although shy and timid, and for the most part avoiding the neighbourhood of cultivated lands, in undisturbed districts they are not excessively wary and difficult of approach. Neither are they, as a rule, vicious, although a solitary bull has been known to charge without provocation; and in all cases when hotly pursued they are apt to turn on their assailants. Colonel Pollok describes

them as at times snorting and stamping when disturbed before making off, and when in headlong flight crashing through tree and bamboo jungle with apparent ease, owing to their enormous weight and strength. The pairing season is stated to take place during the cold weather, and in Peninsular India the calves are, for the most part, dropped in August or September, although a few make their appearance in April, May, or June. The alarm cry of the gaur is a kind of whistling snort ; there is also a sort of mooing cry, and likewise a loud bellow, used as a call. According to Mr. Blanford, none of these sounds are at all like those uttered by the Indian humped cattle.

Some difference of opinion exists as to whether the gaur has ever been domesticated ; and as I have no personal information on this point, I can only quote what has been written by others. Mr. Blanford writes as follows :—" In India all attempts at domestication of this bovine have been failures. The calves appear always to die in captivity, none, it is said, having been known to attain their third year. But there can be little doubt that the gaur has been tamed and kept tame in some of the hill-tracts between Assam and Burma." A paraphrase of this statement was published by myself in the *Royal Natural History*. Commenting thereon, Colonel Pollok makes the following statement :—" In a Natural History lately published, it has been asserted that the gaur has been tamed, and that they are kept in captivity by natives on our north-eastern frontier, but this is altogether erroneous." In a footnote it is added that the writer was evidently misled by Sanderson, whereas in reality, as shown above, I have merely quoted Mr. Blanford, from whom some additional remarks on this subject are referred to under the next species.

As illustrative of the extreme activity of the gaur, the following extract from a correspondent of Colonel Pollok living in Travancore is worth quotation :—

" When the Kaunan Devan Hills in North Travancore were opened out for tea and cinchona some years ago, the felling of the tea forest



BULL GAYAL.

restricted the wild beasts, particularly the elephants and gaur, when passing across the estate, to one or two pathways. One particular track was, however, left to them for about ten years, when further cultivation led at last to the blocking up of even this right of way. The animals were at first much puzzled, and both elephants and gaur took to wandering about the cultivation. The elephants accommodated themselves to the altered conditions and used the estate paths. The gaur, more suspicious, took a straight line for their grazing grounds over the rotten felled timber and through the older cinchona plantations, but were often brought up by the sight of white-washed walls surmounted by a corrugated iron roof. At last they settled down to a pathway between the old cinchona and a natural belt left between it and the new clearing. A pit 10 feet long, 8 feet wide and 8 feet deep, was dug on the boundary, covered with a mat made of reeds and bamboos, over which earth and dry leaves were scattered. The smell of the fresh earth, however, turned them off. Once a gaur got his fore-feet down the side of the pit, but made a bold jump and cleared it."

The title of bison commonly given to this species by Anglo-Indian sportsmen is a misnomer.

2. THE GAYAL—*BOS FRONTALIS*

Bos frontalis, Lambert, *Trans. Linn. Soc.* vol. vii. pp. 57 and 302 (1804); Sundevall, *K. Svenska Vet. Ak. Handl.* for 1844, p. 76 (1846); Blyth, *Journ. As. Soc. Bengal*, vol. xxxi. p. 338 (1862); P. L. Sclater, *Proc. Zool. Soc.* 1866, p. 1, pl. i.; Sarbo, *ibid.* 1883, p. 143; Blanford, *ibid.* 1890, p. 593, *Fauna Brit. India—Mamm.* p. 487 (1891); W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 126 (1891); Huet, *Bull. Soc. Acclim. Paris*, vol. xxxviii. p. 9 (1891); Ward, *Records of Big Game*, p. 274 (1896).

Bos gavæus, Colebrooke, *As. Researches*, vol. viii. p. 488 (1805); Hodgson, *Journ. As. Soc. Bengal*, vol. x. pp. 453 and 470 (1841).

Bos sylhetanus, F. Cuvier, *Hist. Nat. Mamm.* pls. 418, 419 (1824).

Bos (Bison) gavæus, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 406, v. p. 375 (1827).

Urus gavæus, Swainson, *Classif. Quadrupeds*, p. 280 (1835).

Bison sylhetanus, Jardine, *Naturalist's Library—Mamm.* vol. iv. p. 257 (1836).

Bibos frontalis, Gray, *List Mamm. Brit. Mus.* p. 151 (1843), *Cat. Ungulata Brit. Mus.* p. 31 (1852), *Cat. Ruminants Brit. Mus.* p. 13 (1872).

Gavæus frontalis, Hodgson, *Journ. As. Soc. Bengal*, vol. xvi. p. 706 (1847); Horsfield, *Cat. E. Ind. Mus.* p. 179 (1851); Blyth, *Journ. As. Soc. Bengal*, vol. xxix. p. 294 (1860); Sterndale, *Mamm. India*, p. 486 (1884).

Bibos gavæus, Rütimeyer, *Denkschr. schweiz. Ges.* vol. xxii. art. 3, p. 170 (1867), *Abh. schweiz. pal. Ges.* vol. v. p. 189 (1878).

Plate II.

Characters.—Generally very similar to those of the preceding species, but the size smaller, the limbs relatively shorter, the dorsal ridge somewhat less prominent, the dewlap always well developed, and the skull and horns of a markedly different type. The head is decidedly shorter, having almost a triangular form, with the region of the forehead perfectly flat, and the ridge on the summit between the bases of the horns forming a horizontal straight line; the horns themselves are blackish in colour from base to tip, and are but very slightly curved, inclining outwards and more or less upwards, but with no inward bending; in the skull the nasal bones are decidedly shorter than those of the gaur. Hair somewhat longer than in the latter, and the colour distinctly darker, the head and body being dark blackish-brown in both sexes, and the legs from above the knees and hocks to the hoofs pure white or yellowish. Although the domesticated race—apparently the only one of which entire specimens are known—is usually

uniformly coloured, individuals are not unfrequently observed more or less spotted with white, while a few are wholly white.

Although very massively built, the gayal, at least in the semi-domesticated state, stands very considerably lower at the shoulder than the gaur. The horns of a wild bull measured by Mr. Blanford had a length of 14 inches, and the same basal girth. In a domesticated specimen measured by Mr. Rowland Ward the length along the outer curve of the horn is given as 15 inches, the basal girth $11\frac{1}{2}$ inches, and the interval between the tips



FIG. 4.—Bull Gayal. From a photograph of a specimen in the Calcutta Zoological Gardens.

of the two horns $26\frac{3}{4}$ inches. In a second example, of which the horn-length is only $12\frac{5}{8}$ inches, the basal circumference is $27\frac{3}{4}$ inches.

Distribution.—For a long period there was great doubt whether the gayal, or mithan, as it is called in Assam and Chittagong, existed at all in the wild state ; and the opinion has indeed been expressed that the animal is nothing more than a domesticated breed of the gaur. Mr. Blanford, however, records a typical skull in the private collection of Mr. A. O. Hume, obtained by the late Mr. W. Davison in Tenasserim, and identified by the latter as belonging to a wild animal killed by himself in Tenasserim, between Lemyne, 66 miles south by east of Moulmein, and Tenasserim town. This accordingly appears to fix Tenasserim as lying

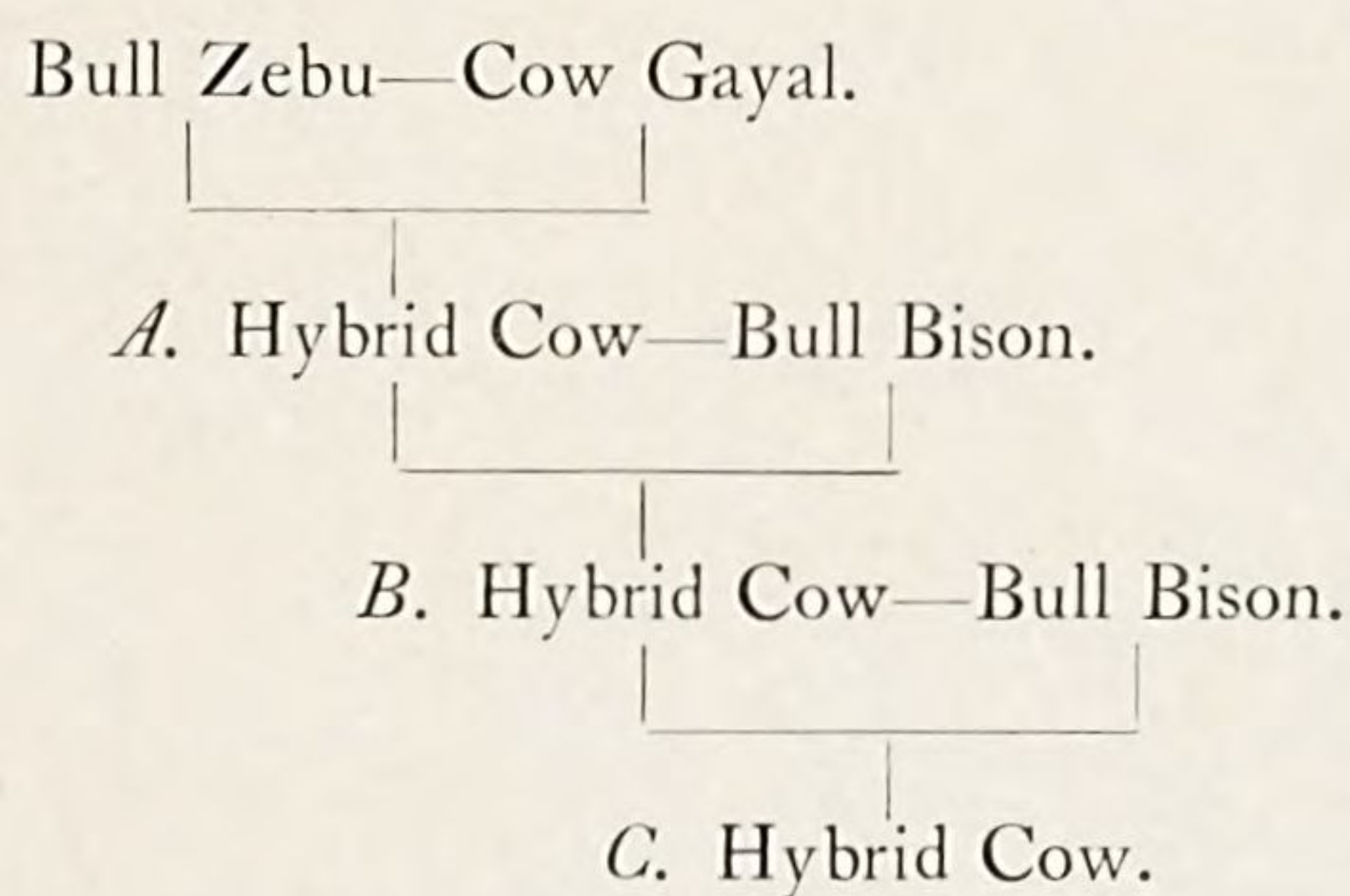
within the distributional area of the species, the limits of which have yet to be defined. But it is distinctly remarkable that since the publication of Mr. Blanford's note in 1891 not a single word in confirmation of the existence of wild gayal has been recorded either by a sportsman or a naturalist; while Burmese sportsmen with whom I have conversed deny the existence of the animal in a wild state in the Tenasserim district.

As mentioned under the head of the preceding species, great confusion has arisen in the descriptions of travellers between gaur and gayal; and the question as to which form some of the animals kept in domestication by the tribes living in the districts to the northward of the Bay of Bengal belong, is still involved in great obscurity. Mr. Blanford's remarks on the question are as follows:—" *Bos frontalis* was described by Lambert and Colebrooke as occurring both in the tame and wild state in the hills of Tipperah among the Kukis; and Lambert gave a detailed account, furnished by Mr. M'Rae, of the capture of wild animals and their domestication by these tribes. It has since been ascertained that tame 'mithans' or 'gayals' are found in possession of particular tribes both north and south of the Assam valley, around Manipur and Cachar, and in the Tipperah, Chittagong, and Lushai hills as far south as the neighbourhood of Chittagong. But the wild bovine of the area in general was ascertained by Blyth, Sarbo, Anderson, and others to be *Bos gaurus*. The later evidence is confusing. Peal (*Nature*, 5th November 1885, p. 7) states that both wild and tame animals are called *mithan* in Upper Assam, that they are perfectly distinct, and no intermediate forms ever occur; whilst Sanderson (*Thirteen Years among the Wild Beasts of India*, p. 250) declares that in Chittagong the two forms, wild and tame, are similar. Lastly, Mr. E. C. Steuart Baker (*Asian*, 6th March 1891, p. 358) in the north Cachar hills confirms the old story of the wild mithans being reclaimed by the Kukis. . . . It is very probable that some of the domesticated *mithans* are *B. gaurus*, the domestication of which by the Kukis was described by Blyth on information

from a missionary, M. Barbe (*Journ. As. Soc. Bengal*, vol. xxix. p. 294). This would explain the old accounts of Mr. M'Rae and the recent one by Mr. Baker, both of which have every appearance of authenticity."

The domesticated herds of gayal enjoy a large amount of liberty, roaming and feeding at will during the daytime through the forest, and returning at nightfall of their own accord to the villages of their owners. They never appear to be used either as beasts of burden or for draught; and their main use seems to be for food. It has indeed been stated that they are also milked, but as the majority at least of the Indo-Chinese tribes by whom these animals are kept are not milk-drinkers, this seems more than doubtful.

Gayal breed freely with the Indian humped cattle, and in the London Zoological Gardens a hybrid between a bull of the latter and a cow gayal proved fertile. The pedigree of the product of the pair, crossed with a male American bison, is as follows :—



The hybrid cow *B.* was thus the product of three perfectly distinct species; so distinct, indeed, that they are regarded by many writers as representing as many genera. And yet the animal was perfectly fertile. As might have been anticipated from the preponderance of bison blood, the hybrid *C.* had lost almost all traces of the characters of the original parents, and become practically indistinguishable from its sire.

3. THE BANTING—*BOS SONDAICUS*

Bos leucoprymnus, Quoy and Gaimard, *Voyage de l'Astrolabe*—*Zool.* vol. i. p. 140 (1830).

Bos sondaicus, Müller and Schlegel, *Verhandl. Nederland Ges.* vol. i. p. 195, pls. xxxv.-xxxix. (1840); Blyth, *Journ. As. Soc. Bengal*, vol. xi. p. 445 (1842), xxxi. p. 336 (1862); Blanford, *Proc. Zool. Soc.* 1890, p. 593, *Fauna Brit. India*—*Mamm.* p. 489 (1891); W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 127 (1891); Huet, *Bull. Soc. Acclim. Paris*, vol. xxxviii. p. 13 (1891); Hose, *Mammals of Borneo*, p. 64 (1893); Evans, *Journ. Bombay Soc.* vol. x. p. 78 (1895); Ward, *Records of Big Game*, p. 278 (1896); Wood, *Zoologist*, ser. 4, vol. i. p. 489 (1897); Lydekker, *Proc. Zool. Soc.* 1898, p. 277; Pollok, *Zoologist*, ser. 4, vol. ii. p. 1 (1898).

Bos banteng, Wagner, Schreber's *Säugethiere*, vol. iv. p. 517 (1844).

Bos banting, Sundevall, *K. Svenska Vet. Ak. Handl.* for 1844, p. 152 (1846).

Bibos banting, Gray, *Knowsley Menagerie*, p. 48 (1850), *Cat. Ungulata Brit. Mus.* p. 35 (1852), *Cat. Ruminants Brit. Mus.* p. 13 (1872); Horsfield, *Cat. E. Ind. Mus.* p. 183 (1851); Jentink, *Notes Leyden Mus.* vol. xx. p. 125, pl. ii. (1898).

Gavæus sondaicus, Blyth, *Journ. As. Soc. Bengal*, vol. xxix. p. 296 (1860); MacMaster, *Notes on Jerdon*, p. 131 (1870); Sterndale, *Mamm. Ind.* p. 488 (1884).

Bibos sondaicus, Rütimeyer, *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 170 (1867), *Abh. schweiz. pal. Ges.* vol. v. p. 189 (1878); P. L. Sclater, *List Anim. Zool. Gardens*, p. 134 (1883).

Plate III.

Characters.—Height ranging from 5 feet to at least 5 feet 9 inches at the withers; build lighter than in the two preceding species, with the legs



JAVAN BANTING.

relatively longer, the head much more elongate and antelope-like, the ridge on the withers less developed, and not forming a distinct hump, the dewlap smaller, the forehead flat, and in old males bearing a rugose horny shield between the bases of the horns. The tail well tufted, and reaching below the hocks. Horns comparatively small and slender, in adults flattened at the base, from which they at first curve outwards and upwards, but towards the tip somewhat backwards and inwards; in young animals cylindrical throughout. General colour of young males and females at all ages reddish-brown, approaching chestnut, and becoming much lighter on the under parts, which may be white, or whitish, as are the inner sides of the legs, the inner surfaces of the ears, and the lips; legs of adults from above the knees and hocks to the hoofs white or whitish; females, and generally the males, with a large white patch on the buttocks, surrounding, but not including, the base of the tail; adult males with the upper-parts varying from blackish-brown, with the aforesaid white rump-patch, to a uniform dark reddish-brown. Young with the outer side of the leg chestnut throughout its length, and a dark streak down the middle of the back.

There are few members of the present group of animals about which our information is more incomplete than it is in the present case; and our museums are sadly deficient in specimen. In addition to a skeleton and numerous skulls, the species is represented in the National Collection by a mounted bull from Java, from which much of the hair has been rubbed off by handling, a mounted head from Burma, and an immature mounted bull, also Burmese. In spite of this deficiency of information, at least two very distinct races are recognisable.

The banting (the tsaing of the Burmese, and the sapi-utan of the Malays) will breed freely with domestic cattle, and is itself kept in a more or less domesticated condition by various native tribes of the Malay countries. It was to a half-bred race that the name *Bos leucoprymnus* was applied by Messrs. Quoy and Gaimard, and it is for this reason that the

name is not employed as the designation of the species. The late acquisition of the blackish colour by the adult males of the typical race, and the permanent retention of the red by both sexes of the second race and by the cows of both, as well as the slighter and smaller horns, point to this species being a less specialised type than either the gayal or the gaur; and it is not improbably a near relation of the extinct Etruscan ox described below:—

The following horn-measurements of this species are recorded by Mr. Rowland Ward:—

Length along Outer Curve.	Basal Circumference.	Tip to Tip.	Greatest Width Inside.	Locality.
30	17	?	?	Java
$28\frac{1}{2}$	15	$26\frac{1}{4}$	$36\frac{3}{4}$	„
$25\frac{3}{4}$	$16\frac{5}{8}$	$20\frac{7}{8}$	$26\frac{3}{4}$	Malay Peninsula
$24\frac{3}{4}$	$12\frac{1}{4}$	$15\frac{3}{4}$	$24\frac{1}{4}$	Java
$21\frac{3}{8}$	$12\frac{1}{4}$	$13\frac{1}{8}$	$19\frac{1}{4}$	Borneo
$20\frac{5}{8}$	$12\frac{1}{4}$	$18\frac{1}{8}$	$22\frac{1}{8}$	„
19	$11\frac{5}{8}$	18	$21\frac{3}{8}$	Java
$17\frac{5}{8}$	$10\frac{3}{8}$	$7\frac{1}{8}$	$14\frac{1}{4}$	Borneo
$17\frac{1}{2}$	$10\frac{1}{8}$	$17\frac{1}{4}$	$20\frac{3}{4}$	Siam
$16\frac{1}{2}$	$10\frac{3}{4}$	$9\frac{1}{2}$	$13\frac{3}{8}$	Borneo

Distribution.—Java, Borneo, probably Sumatra, Bali, the Malay Peninsula, Burma as far as Northern Pegu and Arakan, thence apparently through the hills to the east of Chittagong to Manipur, Siam, and probably other parts of the adjacent districts.

Very little has been recorded of the habits of the Javan race of the banting, but some notes are given below relating to those of the Burmese and Manipur races. Mr. Blanford remarks that, from the greater proportionate length of its limbs, the banting is probably less addicted to climbing rocky hills than the gaur, and is more restricted to the plains of high grass; and this is confirmed by the observations recorded below.

a. JAVAN RACE—*BOS SONDAICUS TYPICUS*

Characters.—Size large, the height at the shoulder reaching to 5 feet 9½ inches, or perhaps more. Old bulls deep blackish-brown or black on the upper-parts, with a large white rump-patch, and the face coloured like the back; somewhat younger bulls very dark chocolate-brown; young bulls and cows bright red-brown, also with the rump-patch and lower part of the legs white; tip of inner surface of ear and a line on the lips white.

This race is represented in the British Museum by the bull from Java already mentioned, which is one of the specimens obtained at the same time as the type. Where the hair still remains, it is very dark chocolate-brown, becoming nearly black a little above the knees, but as the colour has doubtless faded considerably, it is probable that it was originally almost black. As mounted, the specimen stands about 5 feet 3 inches at the shoulder. I had an opportunity of seeing the heads of two bulls from Borneo in 1898 which were almost completely black, with the exception of the above-mentioned white markings, but showed a tendency to rufous just below the eyes.

The late Mr. W. Davison, in a note in the *Proceedings* of the Zoological Society for 1889 (p. 448) on the wild cattle of the Malay Peninsula, refers to one species under its native name of sapio, his description being as follows:—"It is black, but has the belly, the inner sides of both fore and hind legs, and stockings chestnut; the gray patch [of the gaur] on the forehead is rusty, and the insides of the ears are strongly tinged with chestnut. I have seen an old bull, standing over 18 hands, with massive horns, coloured thus; and the other day Dr. E. A. Travers shot in Jelebu a young bull almost exactly the size of the sladang (gaur) now sent, and it was coloured exactly like the large bull. The quite young of this form

are said to be entirely chestnut, and the cows to have the chestnut of the stockings, belly, and inner sides of the legs darker and richer coloured than in the bulls."

From this description it would appear probable that the sapio is really the banting, although it seems somewhat remarkable that no mention is made either of the light patch on the buttocks, or of the horny boss on the vertex of the head between the bases of the horns. Mr. Blanford (*Proc.*

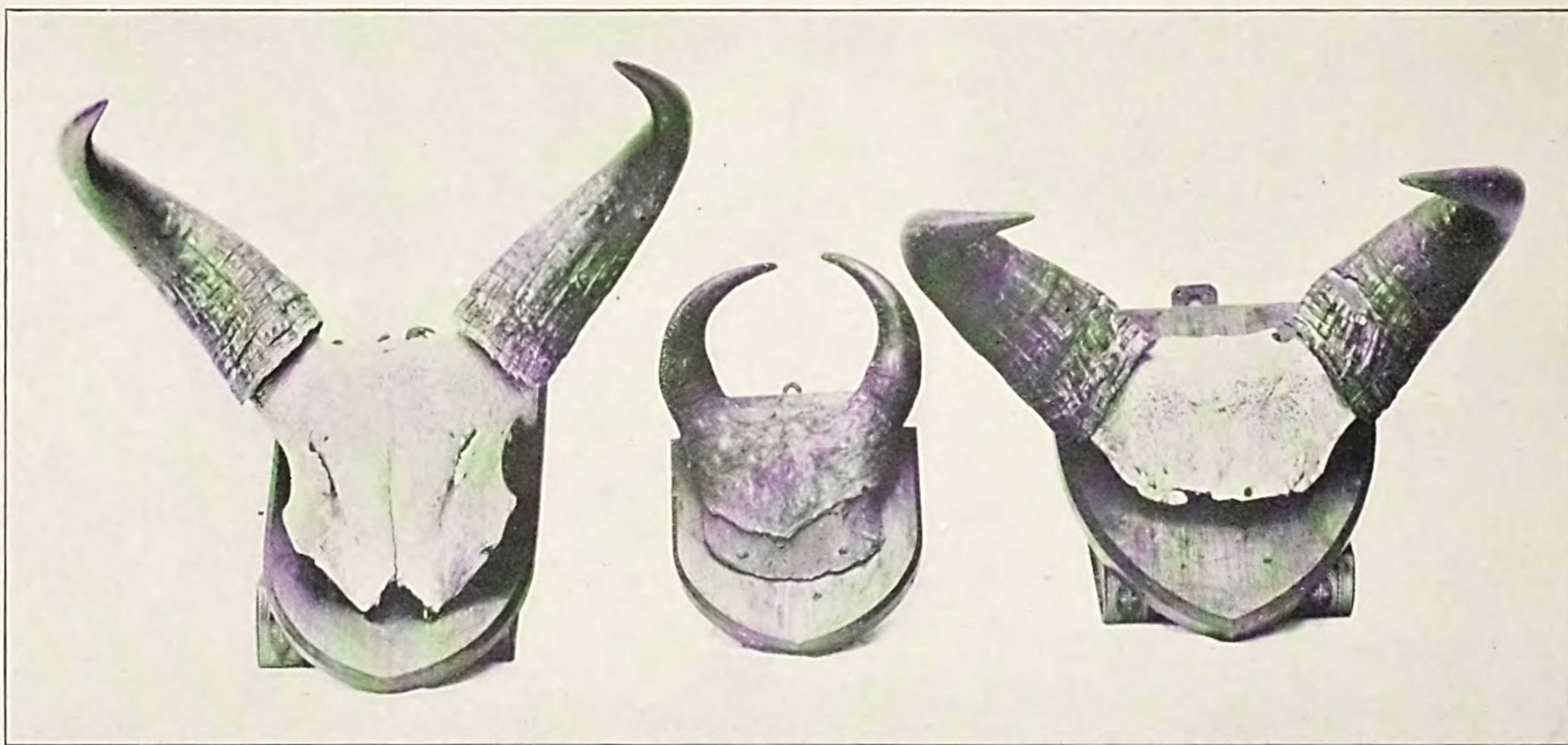


FIG. 5.—Frontlets and horns of three male specimens of the Bornean Banting, of different ages.
From the collection of Sir E. G. Loder.

Zool. Soc. 1890, p. 599), who inclines to the same view, remarks that he has seen a bull gayal with yellow stockings, which, from a periodical exudation, may occasionally assume a ferruginous tinge.

From the black coloration of the upper-parts the Malay so-called sapio seems to be akin to the present race of the banting, but it remains to be determined whether or no its chestnut stockings entitle it to be ranked as a separate local form.

In the typical Javan race the horns spread outwards to a considerable extent, much as in the Burmese head shown in Fig. 6. In many skulls

from Borneo the horns are, however, less spread out, and are directed more upwardly, somewhat after the manner of those of the Galla ox, as in the three examples shown in the accompanying figure. If this difference should prove to be constant, and it is confirmed by skulls in the British Museum, it might indicate that the Bornean banting formed a distinct race, although it has the same dark brown coloration as the Javan form.

Distribution.—Typically Java, but likewise occurring in the islands of Bali, Borneo, probably Sumatra, and perhaps also in the Malay Peninsula.

b. BURMESE RACE—*BOS SONDAICUS BIRMANICUS*

Bos sondaicus birmanicus, Lydekker, *Proc. Zool. Soc.* 1898, p. 277, plate xxv.

Characters.—Stature apparently less than in the preceding race, the maximum recorded height at the shoulder being 5 feet $4\frac{1}{2}$ inches. General colour of adult bulls dark chestnut on the upper-parts, appearing darker in some lights than in others, and shading off into light brown on the under-parts; face dirty gray, typically with a light chestnut patch on the middle of the nose some distance above the muzzle; margin of lips and inner surface of ears whitish; muzzle black; the white rump-patch well developed; upper part of fore-legs darkish gray; fore-legs from a little above the knees, and hind-legs from above the hocks dirty white or yellowish. Young bulls lighter and brighter-coloured, with the markings less distinct. Cows bright reddish-chestnut at all ages; the face being slightly paler, especially round the eyes, on the forehead, and in the neighbourhood of the muzzle, where it is dirty white, as are the under-parts and lower portion of the legs. A full-grown bull measured by Vet.-Capt. Evans stood 5 feet $4\frac{1}{2}$ inches at the withers, and a cow 5 feet 1 inch.

This race is typified by the mounted head of an adult bull, with the

horny plate between the horns fully developed, in the British Museum ; the rest of the description being taken from the memoir by Vet.-Capt. Evans quoted on p. 36. The British Museum possesses a younger bull, in which the horny plate on the crown of the head has only just commenced to be apparent on the line of the back of the base of the horns.



FIG. 6.—Head of male Burmese Banting. From the *Proc. Zool. Soc.* 1898.

Col. Pollok¹ writes that bulls of this race are deep red, with a white rump-patch, although very old ones may be coffee-coloured.

Distribution.—Burma, Pegu, and Arakan ; possibly extending southwards to the Malay Peninsula, and perhaps northwards to the ranges eastward of Chittagong.

Habits.—The Burmese tsaing, according to Vet.-Capt. Evans, is to be met in most parts of the country where suitable grazing and covert occur. They generally go about in small parties numbering from eight to a dozen

¹ *Zoologist*, ser. 4, vol. ii. p. 2 (1898).

head, although in some instances as many as twenty, or even more, may be seen in company. Each herd is led by an old bull, but the band may include two or three younger animals of the same sex. When the bulls advance in age, they are frequently expelled from the herd by their younger and more powerful rivals, and are then compelled to live in solitude. As a rule, they avoid the neighbourhood of villages and exposed cultivated land, although in secluded jungle clearings they may inflict considerable damage on crops. Their food includes grass, leaves, and fallen fruit, young bamboo-shoots being a very favourite nutriment. Although in cloudy weather they continue till a later hour, their usual feeding-time is from early morning till nine or ten o'clock, after which they retire to the shade for repose. Pasturage and other kinds of food appear to be the inducements for considerable local migrations on the part of these animals, the young shoots of the bamboo attracting them to the jungle during the early part of the rainy season. But at this time they are also often driven into the open by the persecution of flies and mosquitoes. During the hot season they seek the deep shade of the dense jungle, but at other seasons of the year prefer thinner and more open covert. Occasionally they visit the lower hills, but never seem to ascend to any great elevation, being thus very unlike the gaur. Except when wounded, tsaing seem indisposed to charge the hunter; the herds dashing off at a rapid pace when first disturbed, but soon settling down again. Solitary bulls do not appear more vicious in disposition than those with the herds.

c. MANIPUR RACE—*Bos SONDAICUS*, VAR.

Characters.—Smaller than the preceding race, the height of the adult male being 5 feet at the shoulder, and distinguished by the red colour of this sex at all ages and the absence of a white patch on the buttocks, which is, however, developed in the female. Male with the ears relatively

short ; general colour dark red, passing into grayish-white on the face, under-parts, and inside of limbs ; no dark line down middle of back ; no white patch on the buttocks ; front of fore-legs above the knees reddish-black ; tip and front margin of ears jet black ; a grayish-white ring round the eyes ; front and sides of upper part of head tawny white ; muzzle grayish-black. Female with the ears larger ; the general colour light red, with a dark line down the back, and the under-parts and a large patch on the buttocks white ; no black on front of fore-leg or on ear. Height at shoulder 4 feet 10 inches.¹

The above is an abbreviation of the description given by Surgeon-Captain H. S. Wood of an adult bull and cow shot by himself in the Kubbu Valley, between Manipur and Northern Burma. From the condition of its front teeth, the bull was regarded as a very old animal, its age being estimated at about twenty years. Presuming it to be a truly wild animal, there can be no question as to its distinctness from the typical Javan race ; and it would likewise seem distinct from the Burmese form, but until specimens are available for comparison, it had best be left unnamed. The forehead of the bull showed the usual callous mass of horny structure between the bases of the horns ; a distinct dorsal ridge, ending abruptly at the middle of the back without forming a hump, and the dewlap slightly developed.

The following are the dimensions of the bull shot by Surg.-Capt. Wood, viz. :—

	ft.	in.
Height at shoulder	5	0
Length (nose to tip of tail over back)	14	0
Length (nose to tip of tail across body)	11	9
Length of head and neck (above)	3	10
Length of head and neck (below)	3	0
Length of tail	2	11
Length of ears	0	10

¹ In the description quoted, the height is given as 3 feet 10 inches, but this seems an error.

	ft.	in.
Girth (middle of body)	7	10
Girth (chest)	7	0
Girth of fore-leg above knee	0	15
Girth of hind-leg above hock	1	6
Girth of neck (middle)	3	10
Girth of haunch	1	11
Length of skull anteriorly	1	11½
Distance between orbits	1	2
Breadth of forehead (between horns)	0	10
Length of left horn (base to tip round curve)	2	9½
Length of right horn (base to tip round curve)	2	7
Girth of right horn (base)	1	4
Girth of left horn (base)	1	5
Distance between tips of horns	2	2⅞
Distance between convexities of horns	3	2

Distribution.—The Kubbu Valley, between Manipur and Northern Burma ; perhaps extending to the ranges eastward of Chittagong, where this form may intergrade with the Burmese race.

Habits.—The following notes on the habits of the Manipur banting, or tsaing (tsaine) are given by Surg.-Capt. Wood :—“These animals,” he writes, “are found in herds varying from ten to thirty in number ; and in the large herds there are generally found two or three small bulls whose heads are not worth obtaining. The largest horns, as is the case in other bovine animals, are found in solitary bulls who keep to themselves, and only occasionally mix with the cows during the breeding-season. When the green grass sprouts up after the yearly fires, the old bulls wander over large areas, and seldom remain in the same locality for two successive days ; while, like the gaur, they are almost always on the move, feeding as they go along and only lying down during the day when the sun is hottest. The tsaing can go for days without water, and the Burmese say that they only drink once in seven days. I have come across herds in absolutely dry districts, miles away from water.

Another peculiarity of the tsaing is that it does not seem to mind the bites of the gad- or horse-fly, with which the teak-forests abound at the beginning of the monsoon. The wild buffalo, which has apparently a much tougher skin, is almost driven mad by these pests, and is compelled to take to the rivers and swamps to avoid them, whereas the tsaing will never resort to the water, but prefers to lie down in the forest surrounded by these buzzing tormentors, when no doubt its long and bushy tail assists in driving off the bloodsuckers. During the rains these animals betake themselves to the low hills, where they feed on the bamboo, with which the hills are covered ; and after the yearly fires they all descend into the valley, and wander through the vast teak-forests. Unlike the gaur, they never come down to the rice-fields of the villagers, and this is probably owing to their extreme shyness. The cow calves during the rains, and the young is of a light red colour, only one being produced at a birth. At the beginning of the rains tsaing are always to be found at the foot of the low hills, where they browse on the tender new bamboo-shoots. These animals also travel great distances to visit the so-called salt-licks, one or two of which are generally found in places where the species is obtained, though many of these salt-licks are nothing more than a mixture of mud and water which has a slightly saline taste. These salt-licks are also visited by hundreds of parrots, green and imperial pigeons, and also by elephants, gaur, pigs, and sambar. The tsaing is often shot at these places by the hunter, who squats up in a tree close by. Gaur and tsaing are never met with together in a herd, although I have found both beasts within the radius of a mile of each other. The spoor of the tsaing is heart-shaped, and very pointed anteriorly, quite unlike the track of a gaur ; this is owing to the hoofs of the former being much more pointed and deer-like. These animals, both when feeding and lying down, always have a sentry, generally a cow. When lying down, they generally rest in a circle ; and when the sentry suspects danger she either stamps her

foot or gets up, and with a 'psheu' and a snort the whole herd stampede, with their tails in the air. Thus alarmed, they go miles before stopping, and it is useless pursuing them under such circumstances. They are always in good condition, although at times subject to cattle disease. All specimens which I have shot had splendid coats, smooth and shining, like that of a well-groomed horse. The skin is much prized by the Burmans for making shoes. The under-parts of the body in one cow were covered with small warts, varying in size from that of a pea to a hazel-nut. The neck of the bull is generally covered with scars, the result of wounds received in combat."

In a private letter the following additional particulars are communicated by the same gentleman :—"There is no doubt of the animal being wild ; its shyness, keenness of scent, and habit of charging when wounded being sufficient to show this. But whether originally wild, or whether formerly domesticated, it is impossible to say. My idea is that it is the original wild ox from which the present domestic Burmese cattle have sprung ; in fact, it is impossible to help remarking the similarity in colouring and general appearance of the cow in both breeds ; the difference lies in the absence of the dorsal ridge in the domesticated cow and the general gameness and antelope-like form of the wild one. In the domestic Burmese bull, on the other hand, I have seen nothing approaching the size and magnificence of a solitary bull tsaing. Such an old bull is one of the finest animals I have ever set eyes on, and I regret that I had not a camera with me to take the specimens shot. An old bull gets almost an iron-gray colour, while the younger ones are dark brown. I have never noticed the white patch on the rump of the male, although this is a marked feature in the female."

iii. THE LEPTOBOVINE GROUP—SUB-GENUS LEPTOBOS (*Extinct*)

Leptobos, Rütimeyer, *Abh. schweiz. pal. Ges.* vol. i. p. 167 (1878); Lydekker, *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 36 (1885).

Characters.—Apparently allied, especially in the shortness of the skull and its nasal bones and the curvature of the cylindrical horns, to the banting, but with the horn-cores of the bulls situated far below the vertex of the skull, midway between the occiput and the orbits, and the cows hornless.

The sub-genus, or genus, was originally described on the evidence of hornless bovine skulls from the Tertiary deposits of the Val d'Arno, which were regarded as specifically distinct from the horned *Bos elatus* of the same deposits. But there can be little or no hesitation in accepting the view of Dr. Forsyth-Major that the one is merely the female of the other.

In the position of the horn-cores of the male and their absence in the female, the members of this group must be regarded as the most primitive representatives of the oxen at present known. Their apparent affinity to the banting is in harmony with the well-ascertained fact that several of the mammalian genera now living in the Malayan countries are related to extinct European Tertiary forms.

Distribution.—The southern part of the Western Holarctic, and a portion of the Oriental region during the Pliocene and Plistocene epochs.

I. THE ETRUSCAN OX—*BOS ELATUS* (*Extinct*)

Bos elatus, Pomel, *Catalogue Méthodique*, p. 114 (1853); Lydekker, *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 19 (1885).

Bos etruscus, Falconer, *Palæontological Memoirs*, vol. ii. p. 481 (1868); Dawkins, *Quart. Journ. Geol. Soc.* vol. xxxvi. p. 394 (1880); Forsyth-Major, *ibid.* vol. xli. p. 6 (1885).

Bos (Bibos) etruscus, Rütimeyer, *Abh. schweiz. pal. Ges.* vol. v. p. 154 (1878).

Leptobos strozzii, Rütimeyer, *op. cit.* p. 167 (1878).

Leptobos elatus, Forsyth-Major, *P. V. Soc. Toscana*, 1890, p. 75.

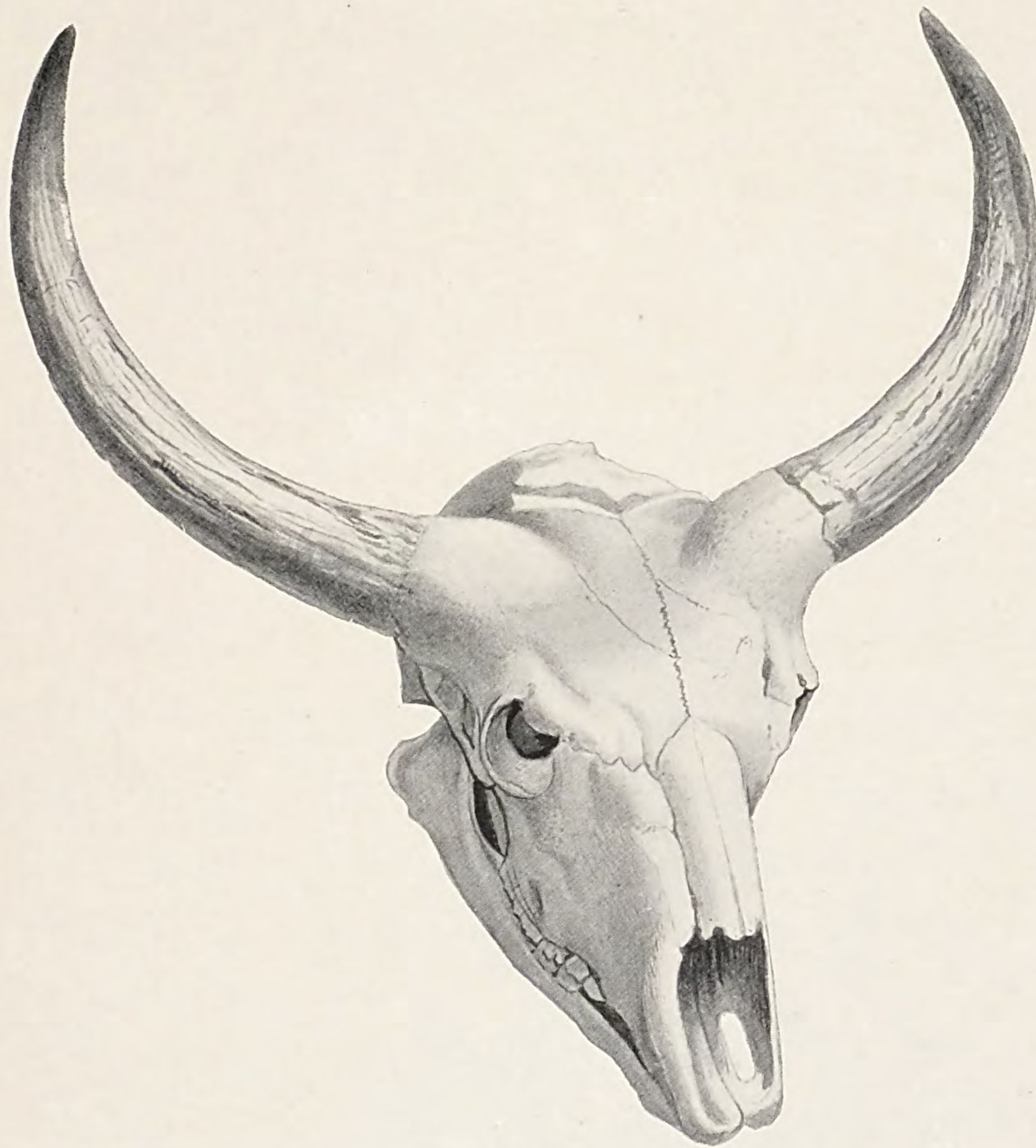


FIG. 7.—Skull and horn-cores of the Extinct Etruscan Ox. From a specimen in the Museum at Florence. After Rütimeyer.

Characters.—Probably of the approximate size of the banting, with the horn-cores of the male diverging at first almost directly outwards, and then curving gradually upwards, with a decided inward inclination at the tips. The limb-bones indicate a comparatively slightly built animal; and the lower molar teeth have a small additional column on the inner side.

Distribution.—France and Italy during the late Pliocene epoch.

2. FALCONER'S OX—*BOS FALCONERI* (*Extinct*)

Leptobos falconeri, Rütimeyer, *Abh. schweiz. pal. Ges.* vol. v. p. 157 (1878); Lydekker, *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 36 (1885).

Characters.—Imperfectly known, but apparently distinguished from the last species by the more slender form of the skull of the male and the more upright direction of the horn-cores, of which the bases alone are preserved.

Distribution.—India during the early Pliocene period, the remains occurring in the freshwater deposits of the Siwalik Hills. An allied species, *Bos fraseri*, said to be still more nearly allied to the banting, occurs in the Plistocene deposits of the Narbada Valley, India.

iv. THE BISONTINE GROUP—SUB-GENUS BISON

Bison, H. Smith, in Griffith's *Animal Kingdom*, vol. v. p. 373 (1827), as a sub-genus; Gray, *Cat. Ungulata Brit. Mus.* p. 35 (1852).

Urus, Bojanus, *Nova Acta Acad. Cæs. Leop.-Car.* vol. xiii. pp. 413 and 428 (1827); Swainson, *Classif. Quadrupeds*, p. 279 (1835); *nec* H. Smith, 1827.

Poëphagus, Gray, *List Mamm. Brit. Mus.* p. 153 (1843), *Cat. Ungulata Brit. Mus.* p. 39 (1852).

Bonasmus, Wagner, in Schreber's *Säugethiere*, vol. iv. p. 515 (1844), as a sub-genus.

Harlanus, Owen, *Proc. Acad. Philadelphia*, 1846, p. 94.

Characters.—Typically the horns cylindrical, widely separated from one another, and situated on a ridge below the extreme vertex of the skull, so that in a front view the summit of the crest of the true occiput is visible; the forehead of the skull relatively short, wide, and more or less convex, the interval between the bases of the horn-cores and the sockets of the eyes



YAK.

relatively small, the sockets of the eyes tubular, and the nasal bones comparatively short and widely separated from the premaxillæ. Withers high ; ribs varying from fourteen to fifteen pairs. Tail reaching about to the hocks. Long hair developed either on the fore-quarters or flanks ; general colour either uniform black or brown.

In the typical members of the group the neural spine¹ of the seventh cervical vertebra is elevated, so as to form a continuation of those of the dorsal series, which are very tall and descend rapidly and suddenly to the lumbar. Whether the same feature exists in the yak, I have been unable to ascertain. It is the most specialised development of this part of the skeleton met with among all the oxen.

Distribution.—The Holarctic and Sonoran regions, extending during the Pliocene period into the Oriental, and in the Plistocene into the Neotropical region.

1. THE YAK—*BOS GRUNNIENS*

Bos grunniens, Linn. *Syst. Nat.* ed. 12, vol. i. p. 99 (1766) ; Sundevall, *K. Svenska Vet. Ak. Handl.* for 1844, p. 153 (1846) ; Radde, *Reisen Öst-Sibirien*, p. 272 (1861) ; Severtzoff, *Ann. Mag. Nat. Hist.* ser. 4, vol. xviii. p. 336 (1876) ; Kinloch, *Large Game Shooting*, vol. ii. p. 5 (1876) ; Flower and Garson, *Cat. Osteol. Mus. Coll. Surg.* pt. ii. p. 227 (1884) ; W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 128 (1891) ; Blanford, *Fauna Brit. India—Mamm.* p. 490 (1891) ; Ward, *Records of Big Game*, p. 277 (1896).

Bos poëphagus, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 404 (1827) ; Pallas, *Zoogr. Rosso-Asiat.* vol. i. p. 248, pl. xxii. (1811) ; Hodgson and Blyth, *Journ. As. Soc. Bengal*, vol. xv. p. 143 (1846).

Bos (Bison) poëphagus, H. Smith, in Griffith's *Animal Kingdom*, vol. v. p. 374 (1827).

¹ See note on p. 8.

Bison poëphagus, Jardine, *Naturalist's Library—Mamm.* vol. iv. p. 259 (1836); Hodgson, *Journ. As. Soc. Bengal*, vol. x. pp. 449 and 912 (1841), xvi. p. 708 (1847).

Poëphagus grunniens, Gray, *List Mamm. Brit. Mus.* p. 153 (1843), *Cat. Ungulata Brit. Mus.* p. 40 (1852), *Proc. Zool. Soc.* 1853, p. 191, pl. xxxv.,

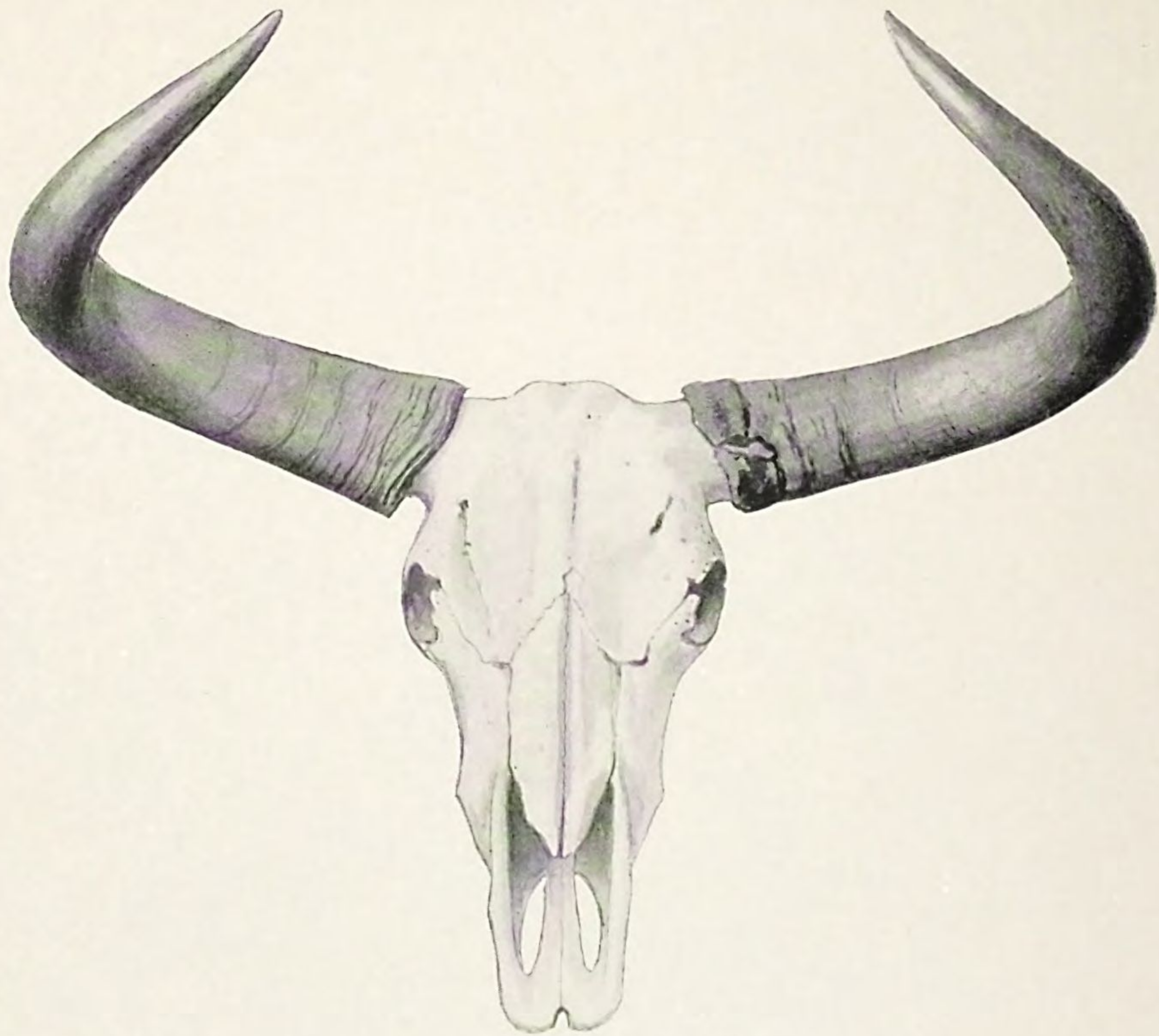


FIG. 8.—Skull of male Yak.

Cat. Ruminants Brit. Mus. p. 14 (1872); Horsfield, *Cat. E. Ind. Mus.* p. 184 (1851); Adams, *Proc. Zool. Soc.* 1858, p. 529; Sterndale, *Mamm. Ind.* p. 489 (1884); Prezewalcki, *Cat. Zool. Coll.* p. 13 (1887).

Poëphagus mutus, Prezewalcki, *Cat. Zool. Coll.* p. 13 (1887).

Bos (Poëphagus) grunniens, Huet, *Bull. Soc. Acclim. Paris*, vol. xxxviii. p. 334 (1891).

Plate IV.

Characters.—Skull relatively long, with the forehead nearly flat, and only a small boss of bone above the true occiput showing in a front view. General build massive and size large; the withers being relatively high, and the back nearly level, without any marked falling away of the hind-quarters; height at shoulder reaching at least 5 feet 6 inches. Limbs short and thick; hoofs large and rounded; muzzle and ears small; dewlap wanting. Horns very large and massive, black in colour, smooth and generally cylindrical, although slightly compressed at the base in very old animals; their curvature at first upwards and outwards, then forwards, and finally inwards and upwards, with a slightly backward inclination at the tips in some examples. Fourteen pairs of ribs. Hair of upper-parts and sides comparatively short and smooth, but on the lower portion of each flank produced into a long fringe extending across the shoulders and thighs; a tuft of similar elongated hair on the chest; and the terminal half of the tail enveloped in a huge tuft of still longer hair, which seldom descends much below the hocks. General colour dark blackish-brown, with a little white in the neighbourhood of the muzzle, a sprinkling of gray on the head and neck in aged individuals, and a rusty tinge on the back of old bulls.

Although 5 feet 6 inches at the shoulder seems to be the maximum height of which there is any definite record, it is stated on good authority that old bulls will reach nearly, if not quite 6 feet. A bull of 5 feet 6 inches at the shoulder measured 7 feet 3 inches from the horns to the root of the tail; the length of the tail being 3 feet 4 inches, and the girth of the body round the chest $7\frac{1}{2}$ feet. Mr. H. M. Biddulph has, however, recorded a specimen measuring 8 feet and $\frac{1}{2}$ inch from the horns to the tail; and a girth at the chest of 9 feet $1\frac{1}{2}$ inches has been measured. The

weight of a wild bull yak has been estimated at between 1100 and 1200 pounds.

The following measurements of horns are given in Mr. Rowland Ward's *Records of Big Game* :—

Length on Outer Curve.	Basal Circumference.	Tip to Tip.	Widest Inside.
$38\frac{1}{4}$	17	19	$31\frac{1}{2}$
$35\frac{1}{4}$	$14\frac{1}{2}$	17	$25\frac{1}{2}$
34	12	$20\frac{1}{2}$	?
$32\frac{3}{4}$	$16\frac{1}{4}$	$27\frac{1}{2}$	$26\frac{3}{8}$
32	$13\frac{7}{8}$	$15\frac{1}{4}$	$22\frac{1}{4}$
$31\frac{7}{8}$	$14\frac{1}{4}$	$18\frac{1}{4}$	?
31	14	?	?
$30\frac{3}{4}$	$13\frac{1}{2}$	$10\frac{1}{2}$	?
$29\frac{3}{4}$	14	12	$25\frac{1}{8}$
$29\frac{1}{2}$	$13\frac{1}{2}$	11	?
28	16	$17\frac{7}{8}$	$26\frac{3}{8}$

The name *Bos grunniens* was doubtless given by Linnæus to the domesticated breed of yak, and Prezewalcki has proposed to designate the wild race as *B. mutus*. If the latter term were used at all, it should be employed in a subspecific sense, but since many of the semi-domesticated yak of Rupshu and some of the other high plateaux in Tibet are practically indistinguishable, except in size, from the wild race, it appears unnecessary. Whether the latter never gives vent to the grunting cry characteristic of the domesticated breeds, I have no information.

Domesticated yak, which are always much smaller than their wild cousins, with very inferior horns, vary much according to locality. In Rupshu they are very large, and generally, if not always, of the uniform colour of the wild race. They run half-wild for much of their time, and are unable to live except at very high elevations. At lower levels in various parts of Ladak and the Himalaya pied domestic breeds are common; and it is from the tails of these that the fly-whisks, or chowris,

used in India are made. Near Darjiling there exists a very small breed of yak, some individuals of which are black, and others black and white. Of this and other breeds living at comparatively low elevations there is a polled form, which probably keeps true. Domestic yak are freely crossed with the ordinary Indian cattle. It is only the comparatively lowland breeds of

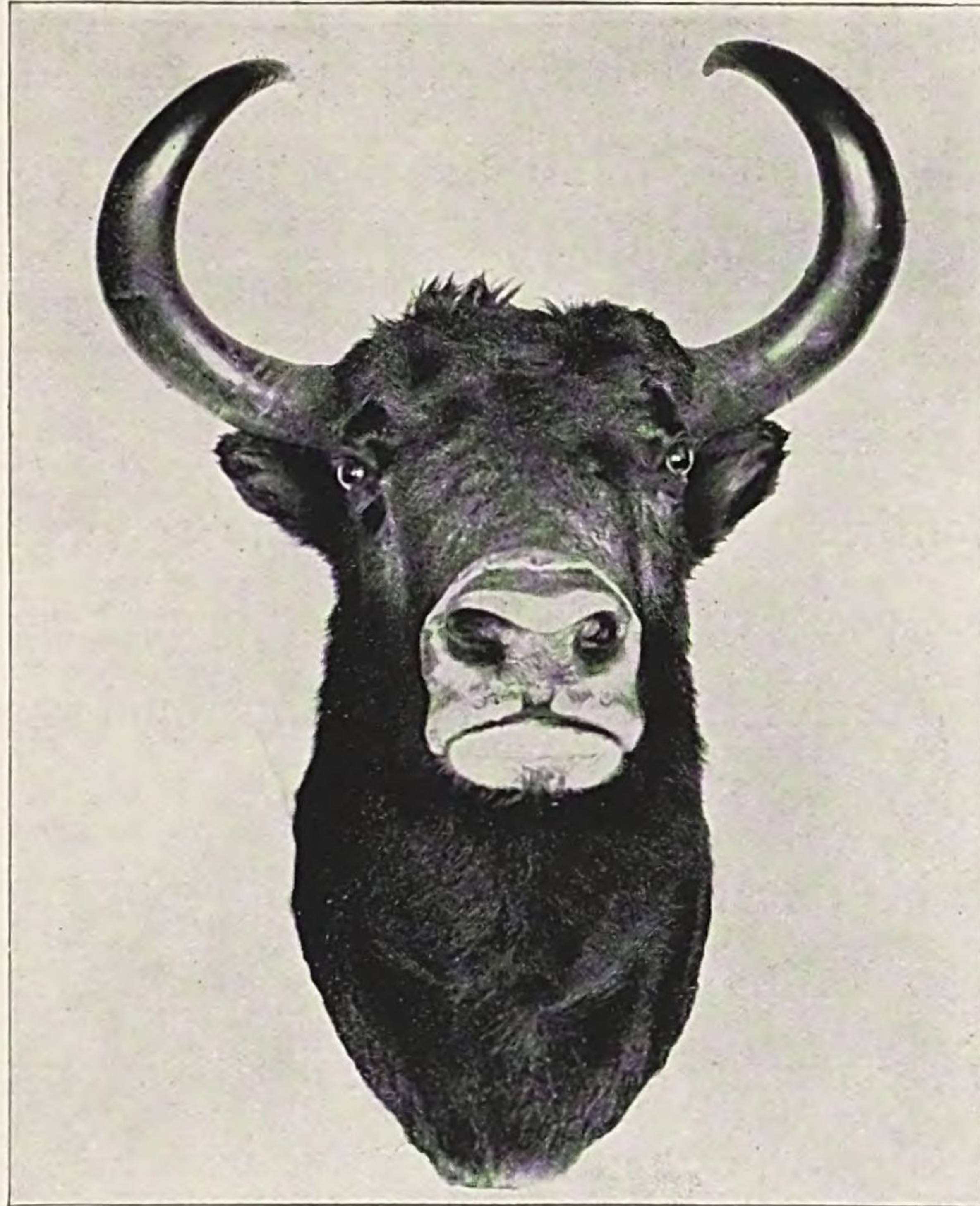


FIG. 9.—Head of Bull Yak. From Darrah's *Sport in the Highlands of Kashmir*.

yak which will stand the climate of India even for a short time, and it is such alone that are exhibited alive in Europe.

In the characters of the skull, yak are to a considerable extent intermediate between the taurine oxen and the true bisons. The comparative length and narrowness of the forehead, as well as its flatness, are taurine characters, as is also the want of prominence of the sockets of the eyes. On the other hand, the occipital region shows a distinct approximation to the bisons. In place, however, of the summit of the true occipital surface being seen in a front view of the skull, as in the latter, only a small boss

of bone surmounting the crest of that surface is, as already said, visible. The whole occipital aspect of the skull takes the form of an inverted V. the summit of which is formed by the aforesaid boss. The presence of fourteen pairs of ribs is an essentially bisontine character ; and it seems highly probable that the mass of long hair on the flanks, as well as the uniform coloration, are also indicative of affinity with that group. The premaxillary bones of the skull differ from those of the taurine group and resemble the bibovine group and the bisons in not extending upwards to join the nasals ; but the interval between these two bones is, as in the gaur, considerably shorter than in the bisons.

On the whole, it seems preferable to regard the yak as an aberrant member of the bisontine group, rather than the representative of a group by itself. This view is supported by the occurrence of the under-mentioned extinct species, which on distributional grounds appears to connect the yak with the living bisons.

Distribution.—The plateau of Tibet, extending eastwards as far as the province of Kansu in China, and northwards probably as far as the Kuen Lun. The south-western range embraces the north-eastern portions of Ladak in the neighbourhood of the Changchenmo valley and the Pangkong lake. In summer yak are found at elevations from about 14,000 or 15,000 to 20,000 feet above the sea-level.

Habits.—In Ladak the regions inhabited by the wild yak are of the most dreary and desolate description, where the pasturage even in summer consists only of patches of a coarse, wiry grass apparently ill-fitted for the nutriment of herds of such large animals. Nevertheless, both yak and argali thrive upon it ; and although in Ladak itself yak are now comparatively few, in Chinese territory they exist in great numbers, and are found in herds numbering from ten to a hundred head or more. The old bulls are, however, for the most part solitary, or go about in small bands of three or four.

As a compensation for its arid and desolate nature, the rock-scenery of parts of the yak-country in Ladak is probably unsurpassed in the world for brilliancy of coloration. When to this is added the presence of a large sheet of water like the Pangkong lake, the whole effect is magnificent. Taking his stand at the north-western extremity of the lake at Lukung, the traveller has for foreground a smooth beach of dazzling white sand, beyond which lies the broad expanse of the clear blue water of the mighty lake ;



FIG. 10.—Champas with Yaks. From Darrah's *Sport in the Highlands of Kashmir*.

while, on either side, there rise rugged cliffs of brilliantly coloured slaty rocks. The contrast of the white beach, blue water, and many-coloured bare rocks, shimmering in the dazzling light of the midday sun, has left on my memory an impression never to be forgotten.

Yak are in the habit of wandering for considerable distances ; and during the daytime are accustomed to repose on some steep and barren hillside, whence they can obtain a good view of the country. Their feeding-times, in Ladak at any rate, are chiefly the early mornings and evenings. Water

is essential to their well-being, and in winter they eat snow. In avoiding their enemies yak seem to rely chiefly on their sense of smell, which is very acute ; their hearing and sight being apparently less keen.

Beyond Ladak, where they are more or less secure from persecution, yak are far less wary. The large herds of cows and young bulls wander over vast tracts of country, and in summer make their appearance on grassy plains which are deserted in winter. The solitary bulls, on the



FIG. 11.—Group of domesticated Yak in the park at Woburn Abbey. From a photograph by the Duchess of Bedford.

other hand, are said to remain in the same districts throughout the year. In all parts of their habitat their favourite feeding-grounds are the patches of grass bordering the streams. When alarmed, the older cows and bulls take up their position on the front and flanks of the herd, but on the near approach of intruders the whole herd gallops off. Although naturally timid and wary, an old bull when wounded will charge viciously, and there are several accounts of narrow escapes by sportsmen from their onset. Little or nothing has been recorded regarding the breeding habits of yak in

the wild state, but in the domesticated condition the calves are said to be born in the autumn.

Within the territories of the Maharaja of Kashmir yak are of more importance to the nomad inhabitants of the Rupshu plateau than to any other tribes. At this elevation neither ordinary cattle nor half-bred yak can exist, and the animals kept by the Rupshu people are all of large size and black in colour, being distinguishable from the wild race merely by their inferior dimensions. They are but little tamed, and after a longer period of rest than usual are often difficult to load, sometimes indeed throwing their burdens as soon as loaded. The number of yak kept in Rupshu some years ago was between 400 and 500, and on the earnings of these animals, which carry merchandise of larger bulk, and on those of their sheep and goats, which bear smaller burdens, the Rupshu people depend largely for their means of subsistence. Between Central Ladak on the one hand, and Gartok in Chinese Tibet, or Lahul in British territory, on the other, they are kept well employed in forwarding traders' goods; and for this service they receive good payment, either in coin or in kind. The one great drawback to the pure-bred yak as a beast of burden in a desolate country is that it will not eat corn, but depends for its subsistence on grass. All the yak that I have seen in Rupshu were pure black, but it is stated that wild cows are occasionally observed with patches of white or gray here and there.



FIG. 12.—Head of Bull Yak.
(Rowland Ward, *Records of Big Game.*)

2. THE SIWALIK BISON—*Bos sivalensis* (*Extinct*)

Bos sivalensis, Falconer, *Palæontological Memoirs*, vol. i. p. 555 (1868); Lydekker, *Horns and Hoofs*, p. 30 (1893).

Bison sivalensis, Lydekker, *Pal. Ind. (Mem. Geol. Surv. Ind.)*, ser. 10, vol. i. p. 122, pls. xv. and xvii. (1878); Rüttimeyer, *Abh. schweiz. pal. Ges.* vol. v. p. 185 (1878); Martin, *Samml. Geol. Mus. Leiden*, vol. iv. p. 61 (1887).

Characters.—This extinct bison was originally named by Falconer on the evidence of a skull from the Siwaliks now lost, and the type must consequently be the upper portion of a skull with parts of the horn-cores described by myself in 1878. That specimen was obtained from the upper Siwalik deposits, which should probably be referred to the newer Pliocene period. Although at first regarded as intermediate between the yak and the bisons, it undoubtedly belongs to a true bison, exhibiting all the characters mentioned under the head of the sub-genus as distinctive of the bisons proper from the yak. In the flatness of the forehead and tubular form of the orbits this skull resembles the European as distinct from the American species; and the Siwalik bison, as the oldest known in the Old World, may be regarded as the ancestral form of the group.

At the time when the Siwalik bison flourished, the outer ranges of the Himalaya (in which its remains are found) were non-existent, while the central ranges and the plateau of Tibet were almost certainly much lower than at present. Consequently it is quite possible that animals like bison may have been able to range from the Punjab into Central Asia.

Whether the yak is also a more specialised off-shoot from the same primitive stock may well be left an open question. But seeing that it is well-nigh certain that this animal has been derived from a bovine living at lower elevations, and that it could scarcely have been a descendant of

the typical oxen, there is no species more likely to have been its ancestor than the present one. If this suggestion should be substantiated, there would be evidence of the close relationship of the yak to the bisons.

Distribution.—Northern India, Java (*vide* Martin, *op. cit.*), and probably the intermediate countries, during the Pliocene period.

3. THE PLISTOCENE BISON—*BOS PRISCUS* (*Extinct*)

Urus priscus, Bojanus, *Nova Acta Acad. Cæs. Leop.-Car.* vol. xiii. p. 427 (1827); Owen, *Rep. Brit. Assoc.* for 1843, p. 232 (1844).

Bison priscus, Owen, *Brit. Foss. Mamm.* p. 491 (1846); Dawkins, *Quart. Journ. Geol. Soc.* vol. xxxi. p. 246 (1875); Wilckens, *Biol. Centralblatt*, vol. v. p. 117 (1885); Allen, *Mem. Mus. Harvard*, vol. iv. p. 5 (1876); Tscherski, *Mém. Acad. St. Pétersbourg*, vol. xl. art. 1, 75 (1892).

Bison antiquus, Leidy, *Proc. Acad. Philadelphia*, vol. vi. p. 117 (1852); Allen, *Mem. Mus. Harvard*, vol. iv. p. 21 (1876); Wilckens, *Biol. Centralblatt*, vol. v. p. 117 (1885); Rhoads, *Proc. Acad. Philadelphia*, 1895, p. 247, 1897, p. 501; Stewart, *Kansas Quarterly*, vol. vi. p. 127 (1897).

Bison crassicornis, Richardson, *Zool. Voy. Herald*, pp. 40 and 139 (1859).

Bison bonasus priscus, Lydekker, *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 24 (1885).

Bison alaskensis, Rhoads, *Proc. Acad. Philadelphia*, 1897, p. 490.

Characters.—Skull and horn-cores considerably larger than in the living European and American bisons, with the forehead relatively broad and flat, and the horn-cores not inclined backwardly at the base, which is thus situated nearly in the plane of the front border of the socket of the eye. The horn-cores themselves long, and generally more or less curving forwards, although in some cases they are straighter and inclined upwards.

This species occurs typically in the Pleistocene deposits of Europe,

ranging from the date of the Norfolk forest-bed to the Ilford brick-earth. A series of skulls in the British Museum shows considerable variation in individual size, and also in the curvature of the horn-cores, but none of the specimens display differences apparently worthy of specific distinction.¹ Among these specimens are a skull and a detached horn-core obtained by Captain Beechey from Eschscholtz Bay, Alaska, which were figured by Dean Buckland, and subsequently made the types of *B. crassicornis* by Sir J. Richardson. One of these has been identified by American writers with



FIG. 13.—Frontlet and horn-cores of the Plistocene Bison. From a specimen in the British Museum discovered in the Plistocene brick-earth of Essex.

Leidy's *B. antiquus*, while the second has been referred to yet another species under the name of *B. alaskensis*. The British Museum has other specimens from the Plistocene deposits of the Porcupine river, Canada; and, taking European and American specimens together, the whole series, in my own opinion, should unquestionably be referred to a single species. Moreover, so far as I can see, the American specimens present no closer approximation to the living New World bison than do those from Europe to its relative of the Old World. It may also be pointed out that during the Plistocene period Asia and North America were almost certainly

¹ The two skulls of the European species represented in Fig. 14 show a considerable sexual difference in the width of the forehead and the size and curvature of the horns.

connected by way of Bering Strait, so that it would be natural to expect to find identical animals on both sides of the line of these straits. And, as a matter of fact, no one has disputed that the remains of the horse, mammoth, and musk-ox found in the northern parts of the two hemispheres are specifically identical.

Possibly there may be sub-specific differences, but it appears to me necessary to accept the conclusion that the Pleistocene bison was a circum-polar species, whose somewhat degenerate descendants developed on the two sides of the Pacific respectively into the living European and American bisons. The earliest known bison in the Old World is the species of which the remains occur in the upper Pliocene deposits of Northern India ; and as the group may certainly be regarded as of Old World origin, it seems very doubtful if it entered America before the Pleistocene epoch. Hence I feel considerable doubt in admitting that certain remains from America are, as is stated to be the case, really of older Pliocene age. The names of these are purposely omitted here, but allusion is made later on to certain other remains from various parts of America which may indicate distinct species, and are in any case of considerable interest from a distributional point of view. In the eastern hemisphere this bison doubtless eventually passed into the living European form, and in the western into the woodland race of the existing American representative of the group.

The following are the dimensions of the horn-cores of five specimens in the British Museum. Several of these in their present condition show some or all their dimensions exceeding those recorded in either of the existing forms. And it must be remembered that to make a true comparison, the horn-cores of the latter should alone be measured ; in other words, the horny external sheaths should be added to the measurements of the fossils, which would give a considerable increase :—

Number.	Length along Outer Curve.	Basal Circumference.	Tip to Tip.	Frontal Width.	Locality.
45,392	23	16	$39\frac{1}{2}$	$13\frac{1}{2}$	Ilford
44,063	$18\frac{1}{2}$	$13\frac{1}{2}$	?	13	Eschscholtz Bay
M. 5,440	$14\frac{1}{2}$	11	$26\frac{1}{2}$	11	Twickenham
M. 5,064	14	11	30	$12\frac{1}{2}$	Crayford
24,589	13	$10\frac{3}{4}$	$32\frac{1}{2}$	12	Porcupine river

Distribution.—The northern portion of both hemispheres, ranging in America from Alaska and the Porcupine river at least as far south as Texas and Georgia. In the Old World it ranged as far west as Yorkshire, and as far south as Spain and Italy, while it was also widely spread over Eastern Europe, whence it extended into Northern Siberia and the New Siberian Islands. Rather than divide the Plistocene bison of the circum-polar countries into one eastern and several western species, it would, in my opinion, be preferable to regard both the living forms as sub-specific modifications of the primitive stock. This has, indeed, been suggested by Prof. Dawkins,¹ who remarks “That in former times the herds [of bison], now rapidly being destroyed by the hunters in the tract of country extending from New Mexico into the British Dominions, were conterminous with those of Asia.” In Britain remains of the bison occur in the river-gravels, brick-earths, and cavern-deposits, but are unknown from the peat of the fens, at the time of deposition of which the animal would consequently appear to have been exterminated.

4. THE EUROPEAN BISON—*BOS BONASUS*

Bos bonasus, Linn. *Syst. Nat.* ed. 12, vol. i. p. 99 (1766); Radde, *Proc. Zool. Soc.* 1893, p. 175; Satunin, *Zool. Jahrb. Syst.* vol. ix. p. 104 (1896).

Bos urus, Boddaert, *Elenchus Anim.* p. 150 (1788); Fischer, *Synop. Mamm.* p. 497 (1839); Huet, *Bull. Soc. Acclim. Paris*, vol. xxxviii. p. 344 (1891); Ward, *Records of Big Game*, p. 279 (1896).

¹ *Early Man in Britain*, p. 97 (1880).



EUROPEAN BISON.

Bos bison, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 398 (1827), *nec* Linn. 1766 ; Sundevall, *K. Svenska Vet. Ak. Handl.* for 1844, p. 154 (1846) ; Blasius, *Säugethiere Deutschlands*, p. 492 (1857).

Bos (Bison) bison, H. Smith, in Griffith's *Animal Kingdom*, vol. v. p. 373 (1827).

Urus nostras, Bojanus, *Nova Acta Acad. Cæs. Leop.-Car.* vol. xiii. p. 413 (1827).

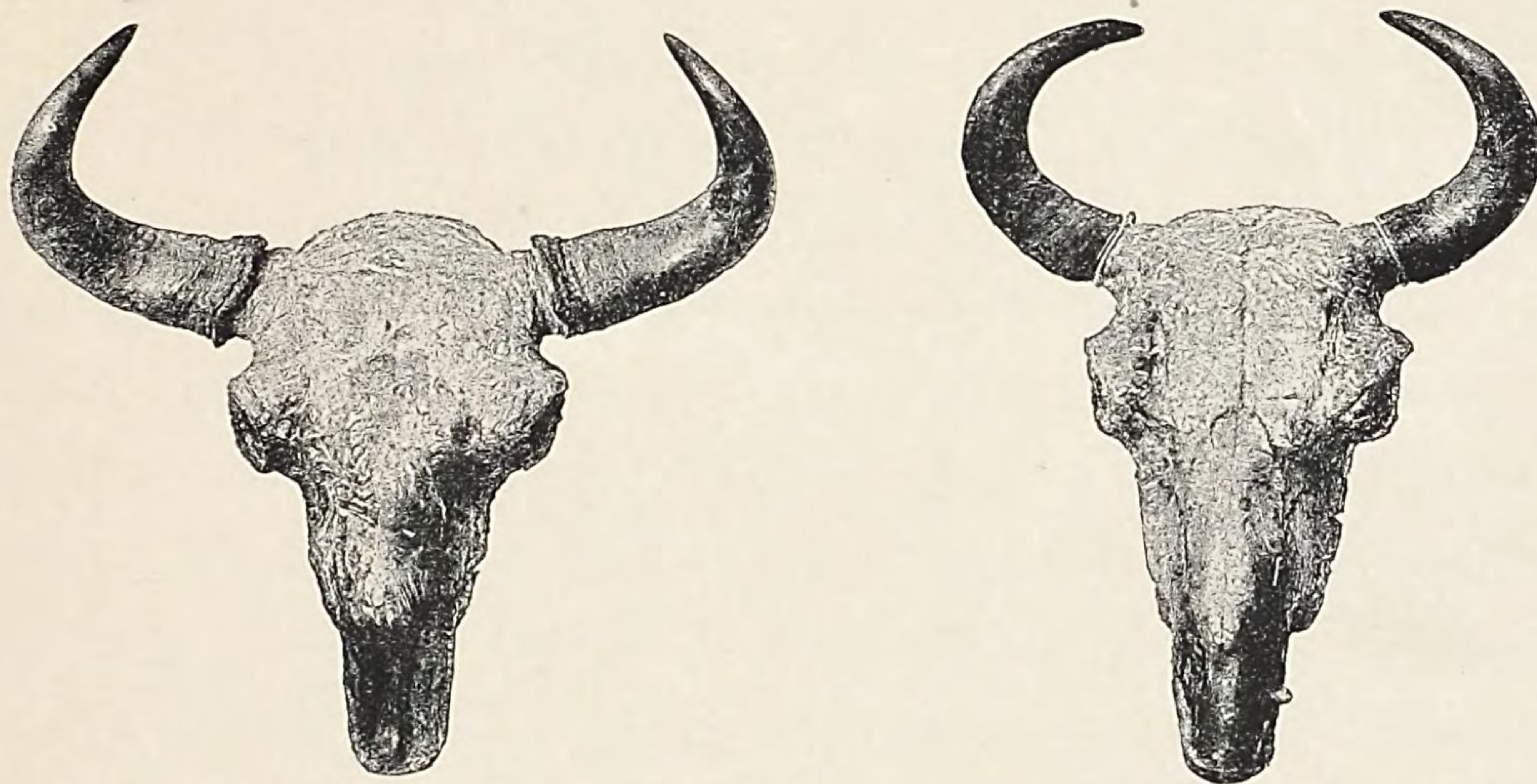


FIG. 14.—Skull and horns of Bull and Cow of European Bison. From specimens shot by Mr. St. George Littledale in the Caucasus. (Rowland Ward, *Records of Big Game*.)

Bos (Bonasus) bison, Wagner, in Schreber's *Säugethiere*, vol. iv. p. 515 (1844).

Bison europæus, Owen, *Proc. Zool. Soc.* 1848, p. 126, *nec Bos europæus*, Gmelin,¹ 1788 ; Rüttimeyer, *Verh. Ges. Basel*, ser. 2, vol. iv. p. 339 (1865), *Abh. schweiz. pal. Ges.* vol. v. p. 139 (1878) ; Dawkins, *Early Man in Britain*, p. 98 (1880) ; Schiemenz, *Biol. Centralblatt*, vol. xvii. p. 479 (1897).

Bison bonassus, Gray, *Knowsley Menagerie*, p. 48 (1850), *Cat. Ungulata Brit. Mus.* p. 36 (1852), *Cat. Ruminants Brit. Mus.* p. 14 (1872).

¹ The specific name *europæus* is generally credited to Gmelin, but his *Bos europæus* (*Syst. Nat.* vol. i. p. 204, 1788) is founded on a domestic cow described some years previously by White in the *Trans. Manchester Litt. and Phil. Soc.* vol. i. p. 442.

Bison bonasus, Flower and Garson, *Cat. Osteol. Mus. Coll. Surg.* pt. ii. p. 232 (1884); Büchner, *Mém. Acad. St. Pétersbourg*, ser. 8, vol. iii. No. 2 (1896); Westberg, *Festschrift Ver. Riga*, 1896, p. 267.

Characters.—Height at shoulder 6 feet 1 inch to 6 feet 2 inches. Horns relatively long and slender, curving upwards, forwards, and inwards, set well forward on the forehead, which is comparatively flat and broad. Hind-quarters relatively high; pasterns long; tail reaching to the hocks, or below. Mane of bull in summer pelage curly and of moderate length and not extending very far back on the body, leaving the heavily fringed ears quite distinct, and forming a longer and thicker mass on the head, neck, throat, and the middle line of the chest. In the cow confined to the nape of the neck, forehead, and middle of lower part of face, throat, and median line of the chest. General colour uniform chestnut-brown throughout, without perceptibly darkening on the mane. In the skeleton the neural spine of the seventh cervical vertebra moderately elevated, and that of the sixth inclined forwards.

The above description is taken from four mounted specimens in the British Museum—namely, an adult bull from Lithuania presented by the Emperor of Russia about the year 1848, a younger Lithuanian bull, and a bull and cow from the Caucasus presented by Mr. St. George Littledale. Between the Lithuanian and Caucasian examples there appear to be no differences even of sub-specific value. It is true that the large Lithuanian bull is considerably taller than the Caucasian specimen and has a shorter tail, but the former difference may be partly exaggerated in the mounting, and the latter seems due to imperfection; the smaller Lithuanian bull, which is mounted in a lying-down posture, having the tail of apparently the same approximate length as in the Caucasian examples. In both the latter the otherwise black hoofs have yellowish-brown margins, which are not apparent in the Lithuanian specimens, but this may be due to the hoofs being less worn in the former than in the latter.

Compared with the American bison, the skull is characterised by the marked flatness of the forehead and the very tubular orbits; the horns extending at first outwards in the plane of the forehead, and then curving forwards, with no backward flexure, and very little incurving towards the tips. The nasal bones are likewise shorter and wider. In all the above respects the European bison is much nearer to the Plistocene bison than is the American species.

The male and female Caucasian skulls in the British Museum show that in the bull the horns at their origin are directed more outwardly and then bend inwardly more suddenly than is the case in the cow, in which they are much more slender and form a more regular curve. The male skull, moreover, is of a shorter and wider type, especially across the forehead, than that of the cow. In the case of fossil skulls very similar differences appear to have been reckoned as of specific importance.

The following dimensions of horns are recorded by Mr. Rowland Ward :—

Length on Outside Curve.	Basal Circumference.	Tip to Tip.	Widest Inside.	Sex.	Locality.
$18\frac{1}{4}$	$12\frac{1}{8}$	$13\frac{3}{4}$	$19\frac{1}{4}$	Male	Lithuania
18	$12\frac{1}{8}$	16	20	„	Caucasus
$17\frac{1}{2}$	10	$18\frac{1}{2}$	?	„	Lithuania
$15\frac{1}{4}$	8	6	?	Female	?
13	$8\frac{1}{4}$	$9\frac{3}{4}$	14	„	Caucasus

In a Caucasian bull killed by Mr. St. George Littledale the length from the nose to the root of the tail measured 10 feet 1 inch, the height at the shoulder 5 feet 11 inches, and the girth of the body approximately 8 feet 4 inches.

Distribution.—As already stated, the Plistocene bison ranged over the greater part of Europe and Northern Asia, and it is now impossible to say at what date its descendants became dwarfed into the modern form. It is,

however, certain that bison were abundant in the Black Forest at the time of Julius Cæsar ; and they doubtless survived in many parts of Germany and other districts of the Continent to a much later period. Owing, however, to the confusion which has arisen in regard to the application of the names aurochs and bison, it is frequently impossible to determine which animal is the one referred to by many of the older writers. At the present day bison appear to be restricted to the Caucasus and the forest of Bielowitza, in the government of Grodno, the old Lithuania. Whereas, however, in the latter locality they are strictly preserved and almost in the condition of park-animals, in the Caucasus, according to Mr. St. George Littledale and Prince Demidoff, they are truly wild, although also under Government protection.

In the Caucasus, Dr. G. Radde states that the bison is at present confined to the districts around the sources of the Laba and Bjellaja, on the north side of the range, extending eastwards to the springs of the Zellentchuk. "It is scarce everywhere, and generally seen in twos and threes ; only once have the tracks of seven together been noticed, although occasionally as many as five have been observed. Evidently the bison has discontinued its settled habits, and has taken to wander about in this, its last refuge. Through the ever-increasing encroachments of the settlers, and the consequent dispersal of the wild animals, and also, in many places, owing to the new supervision of the forests, the bison is driven more and more towards the higher ridges of the mountains, and wanders about in the thick forests which border the lower portion of the Alpine pasturages.

"The most likely places to find this animal are at present near the sources of the Little Laba, and especially on its western confluent, the Urushten. This river is joined by a small stream, the Alaus, in the valley of which the bison is often met with. It is from 7000 to 8000 feet above the sea-level. Formerly, 30 or 40 years ago, it was met with much lower

down, about 5000 feet, and it was also more common. That the bison has now passed over the mountain range, and is wandering southwards is pretty certain. There was an instance of this in 1874, in which year an example was killed not far from Romanonskoje, about a day's journey from Sotschi on the coast."

Till recently even the natives of the Caucasus seem to have been scarcely aware of the existence of the bison, or zubr, as it is called in Russian, in their midst. Prince Demidoff, in *Hunting Trips to the Caucasus*, writes as follows of its range and habits in that district:¹—"Not so long ago the bison used to haunt most of the valleys of the Kouban territories, such as the Zellentchuk, where there are said to be some at the present time, both the Great and Little Laba, Urushten, and elsewhere. But so shy an animal could not long continue to live within easy reach of men, and had constantly to retire before advancing civilisation. It is now concentrated in the dense forests overlooking the valleys of the Kiska, and fifty years hence it is to be feared will have entirely disappeared. There is no doubt of the existence of the bison on the southern part of the Caucasian range, between the hills and the Black Sea; but I have never visited that side, and was told it was much harder work to approach them there, for the slopes are far steeper, and covered with virgin and almost impenetrable forests. When frightened, they wander great distances without taking rest, and are not stopped even by the highest ridges, over which they climb, notwithstanding their weight, which attains 1700 lbs. or more. There is no proof that they do not travel to and fro over the main range in the Kouban district, and I do not see why they should not. I have myself seen their tracks on the snow in September at an altitude of 8000 feet. . . . Some thirty years ago, as I was told by native hunters, the bison used to be seen in herds of fifty or sixty head, but at the present time one rarely sees more than five or six together. Two years ago the Grand Duke's head

¹ In the extract I have ventured to substitute the word bison for aurochs.

keeper, who went to inspect their haunts, counted nine together. He told me they stood before him for some time, gazing at him without seeming at all frightened, and after a good three minutes' standing they turned round and walked slowly away."

In 1887 a male and female bison, now mounted in the British Museum, were killed by Mr. St. George Littledale in the Western Caucasus. In 1895 a third was shot by the Grand Duke Sergius Mikhailovitch, and a fourth by General Schilder; while Prince Demidoff's personal experiences during the same year are detailed in his work. In Bielowitza a pair were shot by Major A. Heber Percy in 1879.

For the latest information with regard to the bison in the forest of Bielowitza, naturalists are indebted to a valuable memoir by Dr. E. Büchner, published in the *Mémoires of the St. Pétersbourg Academy of Sciences*, of which the following is a summary:—With regard to the early history of the herd, there is unfortunately a dearth of information, although since the year 1832 an almost continuous count has been kept of their numbers. It is, however, certain that during the Polish War of 1812 the bison had a bad time of it, although accounts differ as to the number of head that survived. Thus, it is stated by Brincken that, at the close of the war, the number of bison was diminished to 300. This, however, may perhaps refer only to full-grown animals, since Baumersrod states that during his journey through Lithuania in 1813 there were 500 head of all ages. On the other hand, Sachnicki repeats the statement that between 1815 and 1817 the herd numbered scarcely 300. Again, in 1820, Eichwald speaks of 350 as the number of bison then living in the forest; and Dolmatoff at the same time gives the total as 300. There must, however, certainly be some error in their accounts, for, in the official count made early in 1821, the number is given as fully 500.

Whatever may be the truth as to the exact number to which the herd was reduced during the war, there is no doubt that after 1813 it once

again enjoyed more prosperous times, and began rapidly to increase. As early as the winter of 1821 it is stated, for instance, that the number of head of all ages totalled over 700; while in December 1828 Eichwald estimated the number in Bielowitza at 696. In addition to this, from thirty to forty head were at the same time living in the forests of Count Tyschkiewictz. In 1829 the number was set down at 711, of which 663 were adult and 48 young animals; and in the following year the herd was variously estimated at from 700 to 772 head. Eichwald, who is the authority for the latter number, further states that during the first Polish revolution of 1831, the herd lost 115 head, thus reducing its number to 657.

Some error seems, however, undoubtedly to exist with regard to this number, since the first of the regular official counts, which took place in 1832, gives the total number of bison at that time as no less than 770, of which 712 were adult, and the remainder young. Since that date till 1872, with the omission of certain years, the numbers are tabulated as follows, viz. :—

				Adult.	Young.	Total.
1833 .	.	.	.	715	53	768
1834 .	.	.	.	757	53	810
1835 .	.	.	.	777	68	845
1836 .	.	.	.	780	78	858
1837 .	.	.	.	802	58	860
1838 .	.	.	.	852	54	906
1839 .	.	.	.	886	46	932
1840 .	.	.	.	782	35	817
1841 .	.	.	.	875	71	946
1843 .	.	.	.	875	109	984
1844 .	.	.	.	?	?	993
1845 .	.	.	.	945	80	1025
1846 .	.	.	.	1018	77	1095
1848 .	.	.	.	1156	108	1264
1849 .	.	.	.	1254	100	1354
1850 .	.	.	.	1390	170	1560

				Adult.	Young.	Total.
1851	.	.	.	1552	90	1642
1852	.	.	.	1600	148	1748
1853	.	.	.	1642	160	1802
1854	.	.	.	1655	169	1824
1855	.	.	.	?	?	1824
1856	.	.	.	?	?	1771
1857	.	.	.	?	?	1898
1858	.	.	.	?	?	1434
1860	.	.	.	?	?	1575
1861	.	.	.	?	?	1447
1862	.	.	.	1124	127	1251
1863	.	.	.	795	79	874
1865	.	.	.	639	85	724
1868	.	.	.	451	108	559
1869	.	.	.	492	49	541
1870	.	.	.	498	44	542
1871	.	.	.	477	51	528
1872	.	.	.	?	?	528

It will be seen from the foregoing figures that the herd attained its maximum during the years 1851 to 1860, and that after the latter date a steady but irregular decline took place. The absolute maximum was in 1857. Some of the causes of the decline are noticed later on.

From 1873 to 1892 the author furnishes us with another series of tables. From this we learn that while the greater portion of the herd is now contained in the Bielowitza forest, a small number are preserved in the adjacent forest of Swisslotsch, and a third division in the Zoological Gardens of Bielowitza. This table is as follows, viz. :—

				Bielowitza.	Gardens.	Swisslotsch.	Total.
1873	.	.	.	429	44	46	527
1874 (Jan.)	.	.	.	450	32	44	536
„ (Dec.)	.	.	.	481	28	49	558
1876	.	.	.	486	28	52	561
1877 (Jan.)	.	.	.	480	26	53	559
„ (Dec.)	.	.	.	482	27	56	565

European Bison

73

			Bielowitza.	Gardens.	Swisslotsch.	Total.
1879	.	.	485	26	60	571
1880	.	.	493	24	62	579
1881	.	.	486	24	64	574
1882	.	.	509	20	71	600
1883	.	.	501	16	67	592
1885 (Jan.)	.	.	324	6	54	384
„ (Dec.)	.	.	349	8	76	433
1886	.	.	331	8	86	427
1887	.	.	335	11	92	438
1889	.	.	274	10	96	380
1890 (Feb.)	.	.	279	12	100	391
„ (Dec.)	.	.	294	12	97	403
1891 (Dec.)	.	.	363	15	101	479
1892 (Jan.)	.	.	375	15	101	491

This table shows that from 1873 till 1882 the herd was gradually recuperating itself, but that between 1883 and 1885 it suffered a very heavy loss, from which date it went on rapidly diminishing till the end of 1890, when a considerable rise was established ; this increase being also marked in the two following years, when the counting ceased.

Regarding the gradual diminution in the number of the Lithuanian bison, the following are some of the data furnished by the same author. It appears that bison-shooting—unless by special permission—was prohibited in the Bielowitza forest by an imperial ukase in the autumn of 1802. How many animals have actually been shot since that date it is difficult to estimate, as the official records do not seem altogether reliable. It is stated, for instance, that between 1832 and 1860 only eighteen bison were shot ; but Dr. Büchner says that this does not include an example killed in 1848 for the museum at Kiew. In 1860 an imperial hunt was organised in the forest, when twenty-eight bison (eighteen bulls and ten cows) were slaughtered. In 1865 a pair were shot for the museums of Strasburg and Gottingen, and in 1871 one was killed for Helsingfors. Between 1873 and 1892 a total of fifteen head were hunted and slain.

Of these, eight bulls were shot during a hunt organised by the Grand Duke Sergius Mikhailovitch in December 1895.

With the exception that perhaps more cows were killed than is justifiable, the damage done to the herd during these sixty years by actual hunting was certainly not excessive. But the after-effects of these hunts—due to the frightening of the animals by the beaters—appear to have been far more serious. This seems to be most marked after the great hunt of 1860, when, as already said, upwards of twenty-eight fell to the rifles of the sportsmen. In 1860, as shown in the first table, the total number of bison in the forest was believed to be 1575, but as only 1447 were counted in the following season, the herd had suffered a total diminution of 128 head; and it is greatly to be feared that the mortality was mainly due to the ultimate results of the great hunt.

The official records are silent as to the number of bison killed by poachers from 1832 to 1872, although sporting journals and popular literature show that the total must have been by no means inconsiderable. Between 1873 and 1892 the number thus lost is officially given as thirty-six. This is by no means heavy; and since of late years still greater precautions have been taken in guarding the forest, it may be safely concluded that very little harm is now done by poaching.

A certain number of bison have been from time to time captured alive in the forest and presented to various zoological gardens. Foremost among these was a pair captured in 1847 and sent to London in 1848; the British Museum also receiving a skin, which is still exhibited in the mammal gallery. About that date a second pair was presented to a Russian park, a third to the Zoological Gardens of Schönbrunner, near Vienna, and a fourth to the Jardin des Plantes, Paris. In 1864 a bull, cow, and calf were sent to Moscow; and the same year the Zoological Gardens of that city received a bull and cow, together with two calves, the two former of which had been captured with the London specimens in 1847.

In the spring of 1865 four bison were presented to the Prince of Pless, in Silesia, and in 1867 the Zoological Gardens of Gatschina received seven examples, and others two years later. In 1873 a pair was presented to Constantinople, and a second pair to Berlin. A total of thirty-one head are thus known to have been presented up to 1873, since which date there is no definite record that any live bison have been exported, although there is a statement that in 1893 five head were sent to the Prince of Pless for the replenishment of his small Silesian herd.

Mention has already been made of the diminution of the herd during the first Polish uprising, when it lost 115 head. A similar loss occurred at the second revolution. And whereas in 1862 the herd comprised 1124 adult and 127 young animals, in the following year the number of the former fell to 795 and that of the latter to 79; the total loss thus being 377. Although it is commonly stated that the loss was due to the revolutionists shooting down the bison in mass, this is incorrect. The true cause was that Bielowitz lay right in the line of conflict between the revolutionists and the Russian troops, so that the animals perished in a miscellaneous manner.

Human foes are not, however, the only ones against whom the bison have to contend, bears and wolves being their deadly enemies, while it is probable that many calves are killed by lynxes. As far back as 1855 we read that in the summer a great war of extermination was waged against the four-footed foes of the bison. Another great hunt took place in 1861, when the bears were well-nigh extirpated. In 1870 forty wolves, one bear, and five lynxes were accounted for; while in the following year the number killed comprised sixty-three wolves, one bear, and five lynxes. A commission which visited the forest in 1871 took especial pains in the formation of plans for the destruction of the carnivora, with the result that wolves became so scarce that in 1889 only one, in 1890 five, and 1891 six, were all that could be killed. In the official tables the number of bison

killed by wolves and bears is approximately given ; and it appears that in the earlier years from six to eight bison not uncommonly fell annually to wolves, while in one year bears accounted for five. From the years 1873 to 1893 only ten head are known to have been destroyed by the former marauders. Indeed, for the last twenty years the devastation to the herd caused by wild animals may be regarded as of no practical importance.

With regard to epidemics, there is no doubt that the herd has suffered

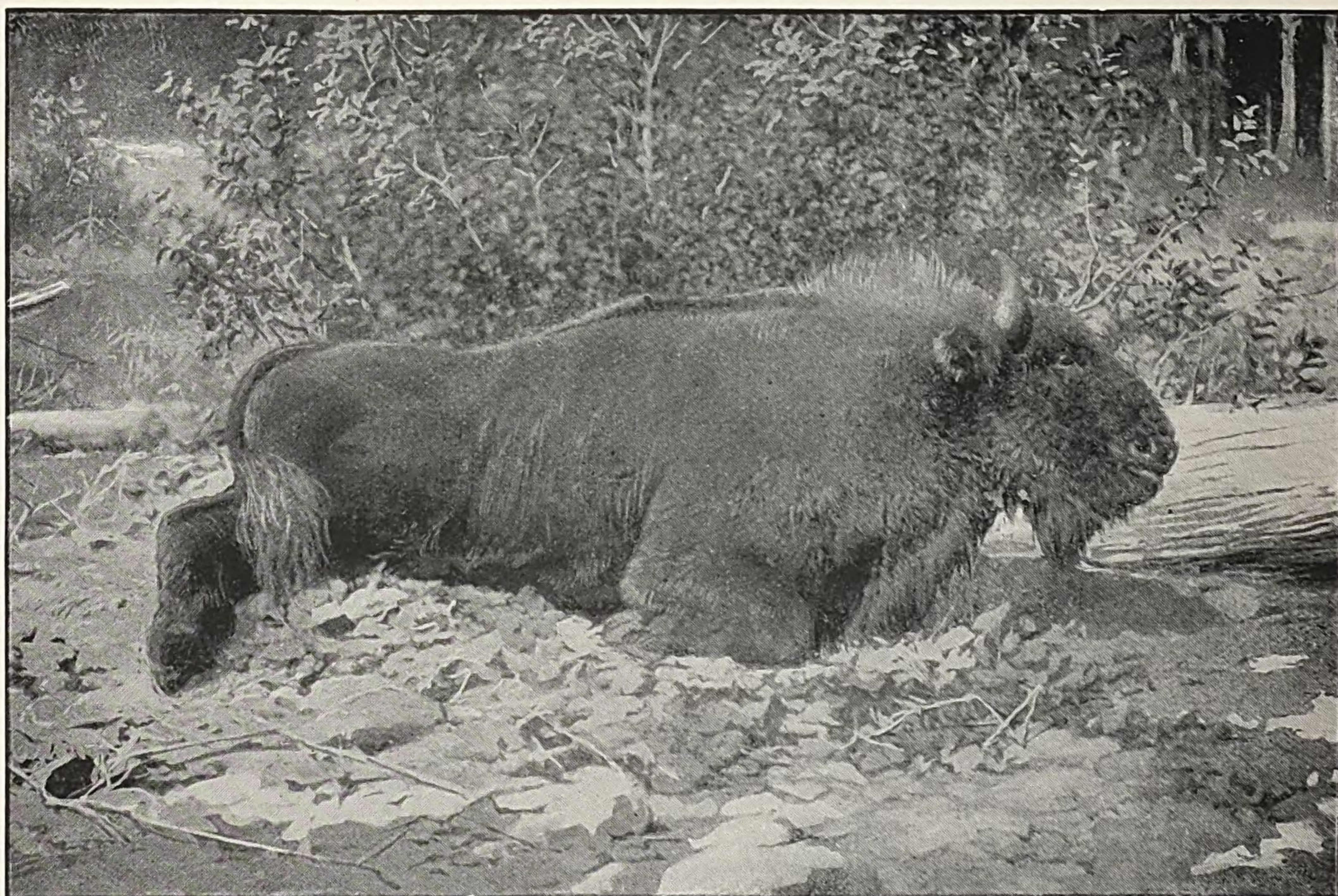


FIG. 15.—Dead European Bison. From Prince Demidoff's *Hunting Trips in the Caucasus*.

much from diseases of this nature. It appears, however, that bison enjoy an immunity both from rinderpest and the so-called Siberian pest ; domestic cattle afflicted with these diseases having on several occasions come into contact with their wild cousins in the forest. Another disease, formerly attributed to the ill-effects of a certain grass growing in the Bielowitza swamps, is now ascertained to be due to liver-fluke. Generally this disease does not do much harm, but in 1884, and again in 1892, it assumed a virulent and almost epidemic form ; in the former year

nine, and in the latter upwards of twenty head falling victims to this scourge.

Passing over certain losses attributed to the bad condition of the fodder in some years, we may conclude with a brief reference to the author's views as to the gradual waning of the Lithuanian bison. This he attributes to continuous in-and-in breeding, the slowness of breeding of the cows, and the large percentage of bulls to the latter. So long ago as 1830 Jarocki recorded that the cows seldom, if ever, calved more than once in three years; while it has been subsequently ascertained that frequently for many years they remain perfectly sterile, although afterwards they may again breed. So slow is the increase, that among some forty adults, it is by no means uncommon to see not more than four calves, while six is an abnormally large number. Although it is now, unfortunately, impossible to determine what was the original rate of increase of the bison, judging from its American cousin, and other considerations, it was almost certainly higher than this. Moreover, the production of a high percentage of males seems an evident sign of degeneration on the part of the females.

Habits.—In its general habits, to which some allusion has been made in the preceding paragraphs, the European bison appears to be very similar to the woodland variety of the American species; both being essentially forest animals. Major Heber Percy states that many of the trees in the Bielowitza forest are magnificent limes; and he also mentions that the bison are fond of grazing on a coarse aromatic kind of grass known as zubr grass, which communicates its aroma to the animals themselves. Other writers state, however, that they are equally fond of browsing on the leaves, young shoots, bark, and twigs of trees, those of the ash being their especial favourites. In pursuit of this food they will strip whole trees as high up as they can reach, while saplings are trampled completely down. In winter they are driven to subsist entirely on buds, twigs, bark, and such patches of dry grass and fern as remain. During spring and summer the herds

frequent the moister districts of the forest, but with the advent of winter seek drier spots where the covert is less dense. The old bulls are solitary, but younger animals consort in summer in parties of from fifteen to twenty head, although in winter they collect in herds of from thirty to fifty. Each herd has its own particular grazing ground, from which it seldom wanders far. Till the commencement of the pairing season, which takes place in August and the early part of September, peace reigns among these herds ; but when two strange herds meet quarrels not unfrequently arise, and during the pairing season the old bulls engage in desperate encounters among themselves for the possession of the cows. Bison are active both during the daytime and the night, but their chief feeding times are during the early mornings and evenings.

Although their large size and stout build might suggest the idea that their movements are slow, yet such is by no means the case ; their first pace when disturbed is a quick trot, which subsequently quickens into a gallop, during which the head is lowered nearly to the ground, and the tail elevated and carried nearly horizontally. Major Heber Percy thus describes a bison-drive in Bielowitza : “ We waited in perfect silence for about half an hour, and then I heard the breaking of sticks and crashing of branches as the herd approached at a gallop. There were about fifteen of them, all thoroughly alarmed, and presenting exactly the appearance of a herd of American bison, the same carriage of the head and the tail carried in the same manner. Though I had but one short view of them, one bull immediately caught my eye as being much larger than the others. . . . At that moment they disappeared in the brushwood, but I could hear them coming straight on towards me, so cocking my rifle, I waited for them to cross the glade to my left. Louder came the noise of the crashing of branches ; and out burst the leading animal across the clearing about eighty yards from me, closely followed by the second and remainder of the herd. Directly the second appeared, I fired at it and rolled it over.”



AMERICAN BISON.

Like their American cousins European bison dearly love a mud-bath, and at times when the flies are troublesome they may frequently be seen plastered over with a coat of dry mud, which forms an efficient protection against their tormentors. During the time they are changing from the winter to the summer coat, the old pelage hangs loosely to parts of the body, and comes away in large blanket-like masses. The cows give birth to their offspring in the thickest and most secluded portions of the forest during the month of May or early part of June, and display great boldness in defending them from the attacks of prowling wolves or bears. It is seldom that more than a single calf is produced at a birth, and, as already stated, in Bielowitza the cows now breed but once in three years, although it is by no means certain that the rate of increase may not formerly have been less slow. At the conclusion of the pairing season, the old bulls once more forsake the herds with which they have temporarily consorted, to resume a solitary and unsociable existence. Although a full-grown bull bison in his prime might appear a match for all foes, it is stated that during winter, when struggling through snow-drifts, even such splendid animals may occasionally be pulled down by packs of wolves; and, according to Prince Demidoff, they are also attacked by leopards.

5. THE AMERICAN BISON—*BOS BISON*

Bos bison, Linn. *Syst. Nat.* ed. 12, vol. i. p. 99 (1766).

Bos americanus, Gmelin, *Syst. Nat.* vol. i. p. 204 (1788); Richardson, *Fauna Bor.-Amer.* p. 279 (1829); Jardine, *Naturalist's Library—Mamm.* vol. iv. p. 252 (1836); Sundevall, *K. Svenska Vet. Ak. Handl.* for 1844, p. 154 (1846); Baird, *Mamm. N. America*, p. 682 (1859); W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 131 (1891); Huet, *Bull. Soc. Acclim. Paris*, vol. xxxviii. p. 344 (1891); Ward, *Records of Big Game*, p. 269 (1896).

Bos (Bison) americanus, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 401, v. p. 374 (1827).

Urus americanus, Swainson, *Classif. Quadrupeds*, p. 280 (1835).

Bos (Bonasus) americanus, Wagner in Schreber's *Säugethiere*, vol. iv. p. 516 (1844); Turner, *Proc. Zool. Soc.* 1850, p. 174.

Bison americanus, Gray, *Knowsley Menagerie*, p. 49 (1850), *Cat. Ungulata Brit. Mus.* p. 38 (1852), *Cat. Ruminants Brit. Mus.* p. 14 (1872); Rüttemeyer, *Denkschr. schweiz. Ges.* vol. xxii. art. 3, p. 91 (1867), *Abh. schweiz. pal. Ges.* vol. v. p. 189 (1878); Allen, *Mem. Mus. Harvard*, vol. iv. p. 36 (1876); Flower and Garson, *Cat. Osteol. Mus. Coll. Surg.* pt. ii. p. 231 (1884); Hornaday, *Rep. U. S. Mus.* 1886-87, p. 378 (1889); Herrick, *Mamm. Minnesota*, p. 260 (1892).

Bison bison, Rhoads, *Amer. Naturalist*, vol. xxviii. p. 526 (1894), *Proc. Acad. Philadelphia*, 1895, p. 244, 1897, p. 501.

Characters.—Height at shoulder typically about 6 feet. Horns in the typical race, usually, shorter, thicker, blunter, and more sharply curved than in the European bison; also set further back on the forehead, which is very markedly convex, so that their bases are considerably behind the plane of the front margin of the sockets of the eyes. Hind-quarters relatively very low and weak in comparison to the withers; pasterns shorter, and the tail less elongated than in the European species. Mane of bull in summer pelage much longer and more shaggy than in the latter, extending further back on the body, and attaining much greater development on the head and neck, where it completely conceals the ears and buries a considerable portion of the horns. In the cow likewise much more copious on the forehead and neck, and leaving but little of the ears exposed. In very old bulls the greater part of the body almost bare when the summer coat is first developed. During winter the whole pelage very coarse and shaggy; the mane of the bulls forming a huge mass of long hair completely concealing the outline of the head, neck, fore-quarters, and

legs. The mane on the head, neck, chest, etc., dark blackish-brown, that on the withers a paler brown, and the pelage of the hind-quarters a kind of cinnamon-colour.

In the skeleton the neural spine of the sixth cervical vertebra¹ is upright, and that of the seventh relatively taller than in the European species, while the spines of all the dorsals are absolutely higher. These features



FIG. 16.—American Bison and Wapiti in the Park at Woburn Abbey. From a photograph by the Duchess of Bedford.

seem undoubtedly indicative of the greater specialisation of the American as compared with the European animal, as is also the marked convexity of the forehead. And assuming the New World form to have been derived from the European species, such greater specialisation is exactly what might have been expected.

In addition to a calf, the British Museum possesses a mounted adult bull from the Yellowstone river, and the head of a second from Colorado, the latter presented by Lord Walsingham. Both appear to be in summer

¹ See note on p. 8.

pelage, and are therefore well adapted for comparison with the specimens of the European species in the collection, all of which were likewise killed at the same season. For comparison of the cows of the two species, reference may be made to the excellent figures in the memoirs of Messrs. Allen and Hornaday. No one who has seen the British Museum examples can fail to be struck with the very marked difference between the males of the European and American forms. In stating that the latter, so far as the typical race is concerned, has generally shorter horns than the former, I am aware that Mr. Rowland Ward has recorded dimensions reached by American specimens exceeding any of those he mentions from Europe. But it must be remembered that in the case of the former animal a vastly larger series of specimens is available for selection; and average specimens are decidedly inferior in size to the few available male skulls of the European bison.

An adult bull bison weighed by Mr. Hornaday turned the scale at 1727 lbs.; and Mr. Rowland Ward states that the general weight may be estimated from about 15 to 20 cwts.

The following are some of the largest horn-measurements mentioned in Mr. Rowland Ward's book; probably No. 10 and certainly No. 11 belong to the woodland race:—

Length on Outer Curve.	Basal Circumference.	Tip to Tip.	Widest Inside.	Locality.
$20\frac{7}{8}$	15	?	$30\frac{1}{2}$	Wyoming
19	$12\frac{1}{2}$	?	?	W. Montana
$18\frac{7}{8}$	$14\frac{3}{4}$	?	$16\frac{7}{8}$	„
$18\frac{1}{4}$	14	$26\frac{1}{4}$	29	Sioux Country
18	14	?	?	Montana
$17\frac{3}{4}$	$12\frac{3}{8}$	$15\frac{1}{8}$	?	?
$17\frac{1}{2}$	$12\frac{1}{2}$	?	?	S.-W. Montana
$17\frac{1}{2}$	12	?	$25\frac{1}{2}$	Wyoming
$17\frac{1}{8}$	$11\frac{3}{8}$	$10\frac{3}{8}$	$17\frac{1}{2}$	?
$16\frac{5}{8}$	$14\frac{1}{4}$	24	?	Bighorn Mts. Wyoming
$16\frac{1}{2}$	$12\frac{1}{2}$	$19\frac{3}{8}$	?	?

Distribution.—Starting from Pennsylvania, which formed its eastern limits, the American bison, according to Mr. Hornaday, originally “extended westward, through a vast tract of dense forest across the Alleghany Mountain system to the prairies along the Mississippi, and southward to the delta of that great system. Although the great plain country of the west was the natural home of the species, where it flourished most abundantly, it also wandered south across Texas to the burning plains of north-eastern Mexico, westward across the Rocky Mountains into New Mexico, Utah, and Idaho, and northward across a vast treeless waste to the bleak and inhospitable shores of the Great Slave Lake itself.” To the northward of the United States the western limits of its range appear to have been formed by the main chain of the Rocky Mountains, along the flanks of which it extended to the Mackenzie river; and the northern shore of the Great Slave Lake seems to have been its most northerly limit. In British territory its easterly range did not extend beyond the plains lying to the west of the highlands bordering Hudson Bay, so that it was entirely absent from the region north of the great lakes.

It will be noticed that in the passage quoted above the bison of the plains is regarded as the original form. This, however, as will be subsequently mentioned, is an error, the woodland form being doubtless nearer the primitive type. Regarding the eastern extension of the animal in Pennsylvania, it is known to have ranged as far as Lewisburg within a comparatively late period, the last individual having been killed in Buffalo Valley, near that town, sometime between 1790 and 1800. Farther east, the bison, according to Mr. S. N. Rhoads, had probably been driven from the Delaware Valley considerably before the advent of the white man in the New World. The same writer adds that, “from the scarcity of its remains and the absence of reliable tradition of its presence in this locality, it is unlikely that this species was ever more than a straggler in the regions east of the Susquehanna river drainage.”

a. PRAIRIE RACE—BOS BISON TYPICUS

Characters.—Generally those given above, the distinctive points of the woodland race being mentioned below.

Distribution.—That portion of the range of the species lying to the south of the distributional area of the woodland race.

Habits.—So much has been written on the habits and extermination of the American bison of the prairies, that it is difficult to know what to select, while it is obvious that nothing new can now be written. The best account of the extermination of the bison from the prairies is one by Mr. W. T. Hornaday; while for a graphic description of the enormous herds which formerly covered these pastures the writings of Colonel Dodge may be consulted. Mr. C. L. Herrick, in his *Mammals of Minnesota*, gives an excellent *résumé* of the general habits of the animal, and Dr. J. A. Allen's memoir will always remain as the most copious history previous to the extermination we yet possess.

In the time of its abundance the bison was an essentially gregarious animal, congregating in herds of such vast magnitude as actually to darken the prairies as far as the eye could reach. Possibly its numbers may have been rivalled by the herds of spring-buck which formerly wandered over the Transvaal; but with this exception, it was probably unique in regard to numerical abundance among Ungulates, and no other animal of equal bodily dimensions ever approached it in this respect. Gregariousness, as has been well observed, necessarily implies periodical migration when the herds are large; and the bison of the prairies was a thorough wanderer. Seasonal changes compelled them at one time to travel in the direction of the mountains, and at another in the opposite direction; while variations in the supply of food and water entailed minor movements in addition to their regular wanderings. Such thousands of

animals would soon consume and destroy vast areas of herbage ; and it has even been suggested that at the time of the maximum development of the race the vast prairies of the north-west were none too large for the sustenance of the herds of bison with which they were covered. The course of streams and rivers marked out to a considerable extent the main direction of migration ; but such lines of march were often altered owing to the occurrence of prairie fires or the presence of devastating hordes of locusts. Previous to the days of railroads, which aided so materially in putting a term to the existence of the race, the periodical migrations of the bison to and fro were so constant and regular that the time for the arrival and departure of the herd in any one locality could be predicted with a close approximation to correctness.

When the herd was alarmed or in danger, its members, as is so generally the case with animals associating in large bodies, seemed to lose all sense of individual responsibility, and rushed madly forwards, heedless of objects which would have effectually stayed the progress of solitary animals. No danger in front would indeed stop the advance of the herd, although unwonted interruptions in its rear would give rise to hopeless confusion.

As an example of this state of affairs the following account from the pen of Colonel Dodge may be quoted :—"The winter of 1871-72 was unusually severe in Kansas. The ponds and smaller streams to the north were all frozen solid, and the bison were forced to the rivers for water. The Atchison, Topeka, and Santa Fé railroad was then in course of construction. If a herd was on the north side of the track it would stand stupidly grazing and without symptom of alarm, though the locomotive passed within a hundred yards. If on the south side of the track, even though at a distance of one or two miles, the passage of a train set the whole herd in the wildest commotion. At its full speed, and utterly regardless of consequences, it would make for the track on its line of

retreat. If the train happened not to be in its path, it crossed the track and stopped, satisfied. If the train was in the way, each individual bison went at it with the desperation of despair, plunging against or between locomotives and cars just as the blind madness happened to take them. Numbers were killed, but numbers still pressed on, only to stop and stare as soon as the obstacle was passed."

Although when direct and level lines of transit were practicable these were preferred, bison displayed remarkable activity and agility for animals of their size in descending and ascending the steep bluffs bordering many of the prairie rivers; and even now the gorges made by the herds in breaking down the banks are still visible as mementoes of a vanished race. Neither would broad and rapid rivers whose currents were encumbered by masses of ice check the course of the host; such transits were, however, frequently accompanied by heavy losses of life, more especially when numbers of animals crowded upon the ice. Arrant stupidity, as in the instance above cited, seems indeed to have been one of the most marked traits in the life-history of the bison.

In reality, however, timidity may account for much of this apparent stupidity, although in defence of their young both sexes displayed undaunted courage. And many anecdotes have been told of the devotion of the cows to their offspring when threatened by imminent peril. "The bulls," writes Mr. Herrick, "invariably range themselves about the circumference of the herd, while the cows and calves remain in the centre. The larger herds when feeding break up into smaller groups, which preserve the same arrangement in obedience to instinct. It appears that the notion, long prevalent, that certain old bulls stand as sentries upon the outskirts of the herds is fallacious, most observers claiming that it is the females, with anxiety quickened by the maternal instinct, which are usually the first to perceive danger. . . . In some cases it is the males upon whom the office of protection devolves, especially in case of attack by wolves.

Wolves were the only animals molesting the bison until the advent of man, and before their numbers were so reduced by hunters these marauders constantly harassed the herds. . . . When separated from the herd the mother was often obliged to pass the night in sleepless vigil, pacing about her sleeping calf."

In reference to the last statement, there have been observed in many places on the prairie circles of five or six feet in diameter of taller and greener grass than the ordinary sward, which appear to have sprung up on the tracks of a cow thus protecting her calf. Much more rarely similar half-circles have been noticed, which are attributed to a cow walking between her recumbent calf on one side and a watchful wolf on the other. An instance has also been recorded where a party of bulls combined to rescue a newly-born calf from the jaws of one of these devourers. Although calves doubtless formed the chief prey of the wolves prowling round the confines of the herd, it was not by any means to these alone that the attacks of the latter were confined. Old, sickly, and wounded individuals of both sexes from time to time fell victims ; and Catlin has given a sad picture of a feeble old bull standing on the defensive against a pack of hungry wolves and gradually succumbing.

In many of their habits bison were more like buffalo than domestic cattle. In their fondness for rubbing they resembled both ; and traces of this habit are to be found in the polished surfaces of the few masses of rock which project above the level prairies, as well as in the smoothed bark of the small number of trees dotted over the same. In their partiality for wallowing in mud they were much more like buffalo. And so ingrained was this habit that old bulls were accustomed to make "wallows" for themselves when ready-made ones were not to be found. "Finding in the low parts of the prairies," says Catlin, "a little stagnant water amongst the grass, and the ground underneath soft and saturated with moisture, an old bull lowers himself upon one knee, plunges his horns into the ground,

throwing up the earth and soon making an excavation into which the water trickles, forming for him in a short time a cool and comfortable bath, in which he wallows 'like a hog in the mire.' In this 'delectable lava' he throws himself flat on his side, and then forcing himself violently around with his horns, his feet, and huge hump, ploughs up the ground still more, thus enlarging the pool till at length he becomes nearly immersed. Besmeared with a coating of the pasty mixture, he at length rises, changed into a 'monster of mud and ugliness,' with the black mud dripping from his shaggy mane and thick woolly coat. The mud soon drying upon his body ensures him hours of immunity from the attack of insects. Others follow in succession, having waited in their turns to enjoy the luxury ; each rolls and wallows in a similar way, adding a little to the dimensions of the hole, and carrying away a share of the adhesive mud. By this means an excavation is eventually made having a diameter of 15 or 20 feet, and 2 feet in depth." Such wallowing holes remain as another sad memento of one of the noblest of American quadrupeds.

The pairing season on the prairies took place in July and August, varying perhaps a little in time according to latitude ; and the young, which never exceeded two at a birth, were born from the following March to June. The calves always went about with the main herd. In the breeding season constant conflicts took place between rival bulls ; but owing to the shortness and form of their horns and the large mass of hair on the fore-quarters, little damage was in most cases inflicted, although the bellowing of the enraged combatants has been described as terrific.

The saddest point in the history of the animal was its rapid and practically complete extermination, which was a surprise even to the hunters themselves. And additional sadness is added to the story from the fact that thousands were slaughtered for so-called sport, and other thousands for no adequate return at all, perhaps merely for the sake of the tongue or some other dainty morsel. The story is too long to be told here ; but it

may be mentioned that between the years 1870 and 1875 the annual rate of destruction has been estimated at fully two and a half million head. The final act in the drama was the completion of the Union Pacific Railway, which cut the main herd in two. The southern half of the divided herd was rapidly exterminated, and it was not long before the northern half followed suit.

The American bison breeds freely in captivity with its own kind, and less readily with other species of cattle. Mention has been made above of the hybrids produced by a union between the bull bison and the cow gayal; and in America a breed has been raised by crossing a bull bison with a domesticated cow. Such hybrids are fertile either *inter se*, or when again crossed with domesticated cattle. A herd of partially hybrid bison was formerly kept at Garden City, Kansas. Bison have been kept in at least two English parks. Mr. C. J. Leyland, of Haggerston Castle, Northumberland, has a small herd, of which the first members were imported from Lincoln Park, Chicago, in the summer of 1890. Others were imported in 1891, and a bull bred in the Regent's Park was also added. About 1893 four half-breeds were raised in this park—three females and one bull. A small herd of bison is also kept in the park at Woburn Abbey, the members of which share a large paddock with wapiti and other deer (fig. 16).

In America, among other localities, a herd has been established at Stony Mountains, Manitoba. Starting with five calves in 1878, the owner had raised the number at the commencement of 1887 to sixty-one head, the greater number of which were pure-bred, and the remainder half-breeds. Although living in the open prairie, and feeding on the snow-covered grass, even in January they were fat and sleek, when the thermometer was much below zero.

b. WOODLAND RACE—*BOS BISON ATHABASCÆ*

Bison bison athabascæ, Rhoads, *Proc. Acad. Philadelphia*, 1897, p. 498.

Characters.—Distinguished from the prairie race by its superior size, thicker and more silky pelage, of which the colour is darker, and by the much longer, more slender, and more incurved horns, which are also more widely separated from one another at the bases.

The description of the type specimen, which is mounted in the Geological Museum, Ottawa, Canada, and appears to have been killed near the Great Slave Lake, is as follows. Pelage uniformly dense and silky; short and fine over much of the hinder half of the body, but becoming very dense, long, and curly anteriorly, especially on the shoulders and neck, as well as the front of the head. Colour along the crest of the hump and the middle line of the back light brown, shading in every direction into darker brown, and becoming almost black on the head, under-parts, and limbs; the ears, muzzle, and lower half of the tail, as well as the horns and hoofs being completely black. The horns long and strongly curved inwards so as to come within a couple of inches of the line of the base of the eyes.

Distribution.—The wooded uplands of the western territories, formerly extending from the eastern slopes of the Rocky Mountains to the 95th meridian of longitude, and from latitude 63° to 55° N., but probably ranging as far south along the line of the Rocky Mountains as the United States.

Habits.—Hunters and trappers have long been convinced of the distinctness of the bison of the wooded northern districts from the one inhabiting the plains, but it is only recently that naturalists have ventured to separate the two. From the accounts of several observers familiar with it in former days quoted by Mr. Rhoads, it appears that the woodland

bison never left the wooded districts, and that when it met the prairie variety on the borderland of their respective habitats, the two kept completely apart. In this respect they resembled the woodland and barren-ground races of the reindeer ; the two races being stated by the aforesaid observer to be as well entitled to rank as sub-species as are the two former. Although they graze occasionally, the woodland bison are stated to subsist chiefly on the leaves and twigs of the birch and willow, whereas the prairie animal is solely a grass-eater.

Never, apparently, very numerous, the woodland race is now approaching extermination. Mr. H. I. Moberly informed Mr. Rhoads that in 1897 he estimated the total number remaining at between 250 and 300 head, which were divided into two herds. One of these bands frequents the districts lying to the north of the lower part of the Peace river, extending from close to the Great Slave Lake at Peace Point, which is about 90 miles below Fort Vermilion. The second band is on the upper part of the Hay river, ranging between the Peace and the Liard rivers and along the foot of the Rocky Mountains for a distance of about 250 miles.

From the fact that the European bison is a forest-dwelling animal, and that the Old World may be regarded as the original home of the group, it seems most probable that the woodland bison is the older type of the two, the prairie race being a somewhat degenerate later development which has taken to a life in the open country at a comparatively recent date. And it is noteworthy that in the width of the skull this race makes an approach to the fossil form described as *B. latifrons*, which occurs typically in Kentucky. It may be well to mention that in his account of the extermination of the bison Mr. Hornaday believed that the woodland race was the smaller of the two, and that it represented a species in course of evolution from the prairie form.

6. HARLAN'S BISON—*BOS LATIFRONS* (*Extinct*)

Bos latifrons, Harlan, *Fauna Americana*, p. 273 (1825) ; H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 410 (1827) ; Lydekker, *Horns and Hoofs*, p. 37 (1893).

Bison latifrons, Leidy, *Proc. Acad. Philadelphia*, vol. vi. p. 117 (1852), *Extinct Vertebrata Western Territories* (U. S. Geol. Survey), pp. 253 and 318 (1873) ; Allen, *Mem. Mus. Harvard*, vol. iv. p. 7 (1876) ; Wilckens, *Biol. Centralblatt*, vol. v. p. 117 (1885) ; Lydekker, *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 27 (1885) ; Rhoads, *Proc. Acad. Philadelphia*, 1895, p. 245, 1897, p. 500 ; Stewart, *Kansas Quarterly*, vol. v. p. 127 (1897).

Characters.—The enormous size, wide, flat forehead, and long, nearly straight horn-cores seem to indicate the specific distinctness of this southern form from *Bos priscus*. In a skull in the British Museum from the Brazos river, Texas, the horn-cores, although very imperfect, measure 45 inches along the curve, with a basal girth of $16\frac{1}{2}$ inches ; the frontal width being 14 inches. When complete, the length along the curve must have been at least 60 inches.

Distribution.—The southern United States, especially eastern Kentucky and Texas, during the Plistocene period.

7. THE CENTRAL AMERICAN BISON—*BOS SCAPHOCEROS* (*Extinct*)

Bison scaphoceros, Cope, *Journ. Acad. Philadelphia*, 1895, p. 457 ; Rhoads, *Proc. Acad. Philadelphia*, 1897, p. 500.

Characters.—The extreme southern range of this form is in favour of its right to specific distinctness ; and, in any case, renders it of special interest as marking the extreme southern limit reached by any member of the hollow-horned ruminants in America. The horn-cores are remarkable for their abrupt curvature, and are also relatively stout.

Distribution.—The mountainous districts of Southern Mexico and Northern Nicaragua, it is said, during the Pliocene period.

V. BUBALINE GROUP—SUB-GENUS BUBALUS

Bubalus, H. Smith, in Griffith's *Animal Kingdom*, vol. v. p. 371 (1827), as a sub-genus; Gray, *Cat. Ungulata Brit. Mus.* p. 23 (1852).

Anoa, H. Smith, in Griffith's *Animal Kingdom*, vol. v. p. 355 (1827), as a sub-genus; Gray, *Cat. Ungulata Brit. Mus.* p. 29 (1852).

Buffelus, Rütimeyer, *Verh. Ges. Basel*, ser. 2, vol. iv. p. 334 (1865), *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 52 (1867), *Abh. schweiz. pal. Ges.* vol. v. p. 189 (1878); Matschie, *Säugeth. deutsch. Öst.-Afrika*, p. 107 (1896).

Probubulus, Rütimeyer,¹ *Verh. Ges. Basel*, ser. 2, vol. iv. p. 334 (1865), *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 52 (1867), *Abh. schweiz. pal. Ges.* vol. v. p. 122 (1878).

Hemibos, Rütimeyer, *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 22 (1867); Falconer and Cautley, in Falconer's *Pal. Mem.* vol. i. p. 456 (1868).

Amphibos, Rütimeyer, *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 29 (1867), *Abh. schweiz. pal. Ges.* vol. v. p. 147 (1878); Falconer and Cautley, in Falconer's *Pal. Mem.* p. 547 (1868).

Peribos, Lydekker, *Pal. Ind. (Mem. Geol. Surv. Ind.)*, ser. 10, vol. i. p. 141 (1878).

Characters.—Build generally massive; neck short; muzzle broad; hair more or less sparse, leaving the skin in old age nearly bare; feet and hoofs large and broad; and the tail of moderate length, with a terminal tuft of variable size. Horns usually large and massive, angulated, and more or

¹ This name was suggested for the *anoa*, together with *Hemibos sivalensis* (= *triquetricornis*) and *Amphibos acuticornis*, but as neither of these two latter were then described, it must be typified by the Celebes buffalo, and is thus a synonym of the earlier *Anoa*.

less distinctly triangular in section at the base ; marked by irregular transverse rugosities for about two-thirds of their length, but becoming more or less smooth and polished towards the tip ; situated low down on the forehead of the skull, considerably below the plane of the occiput, and frequently receding from the forehead, which is more or less distinctly convex in the larger living forms, but flat, or nearly so, in the smaller ones, as well as in many of the extinct species ; their upper border generally concave, and the tips more or less inclined inwards. The premaxillæ of the skull reach upwards to join the nasal bones ; and there are thirteen pairs of ribs. Size large to small.

In the skeleton the neural spines of the dorsal vertebræ, although narrower, have much the same form and relations as in the typical group, but that of the seventh cervical is rather taller.

The buffaloes are the most aberrant of the wild cattle, none of them, so far as known, breeding either with domestic cattle or with the members of the bison group. The African buffalo (with its local races) differs so remarkably from the Indian representative of the group, that they might almost be assigned to distinct sub-genera. But the anoa, which is very generally referred to a genus, or sub-genus, by itself, is so intimately connected with the Indian buffalo through the Philippine species, that there seems no justification for its sub-generic separation.

Distribution.—At the present day restricted in the wild state to the Ethiopian and Oriental regions, but occurring in the Plistocene deposits of Europe and Algeria.

I. THE AFRICAN BUFFALO—*BOS CAFFER*

Bos caffer, Sparrman, *K. Svenska Vet. Ak. Handl.* vol. xl. p. 79 (1779) ; Sundevall, *ibid.* for 1844, p. 153 (1846) ; Huet, *Bull. Soc. Acclim. Paris*, vol. xxxviii. p. 338 (1891) ; Flower and Lydekker, *Study of Mammals*,

p. 361 (1891); W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 130 (1891); Nicolls and Eglington, *Sportsman in South Africa*, p. 72 (1892); Ward, *Records of Big Game*, p. 261 (1896).

Bos (Bubalus) caffer, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 384, v. p. 371 (1827).

Bubalus caffer, Jardine, *Naturalist's Library—Mamm.* vol. iv. p. 237 (1836); Gray, *List Mamm. Brit. Mus.* p. 153 (1843); *Cat. Ungulata Brit. Mus.* p. 28 (1852), *Cat. Ruminants Brit. Mus.* p. 12 (1872), Brooke, *Proc. Zool. Soc.* 1873, p. 480, 1875, p. 457; Flower and Garson, *Cat.*

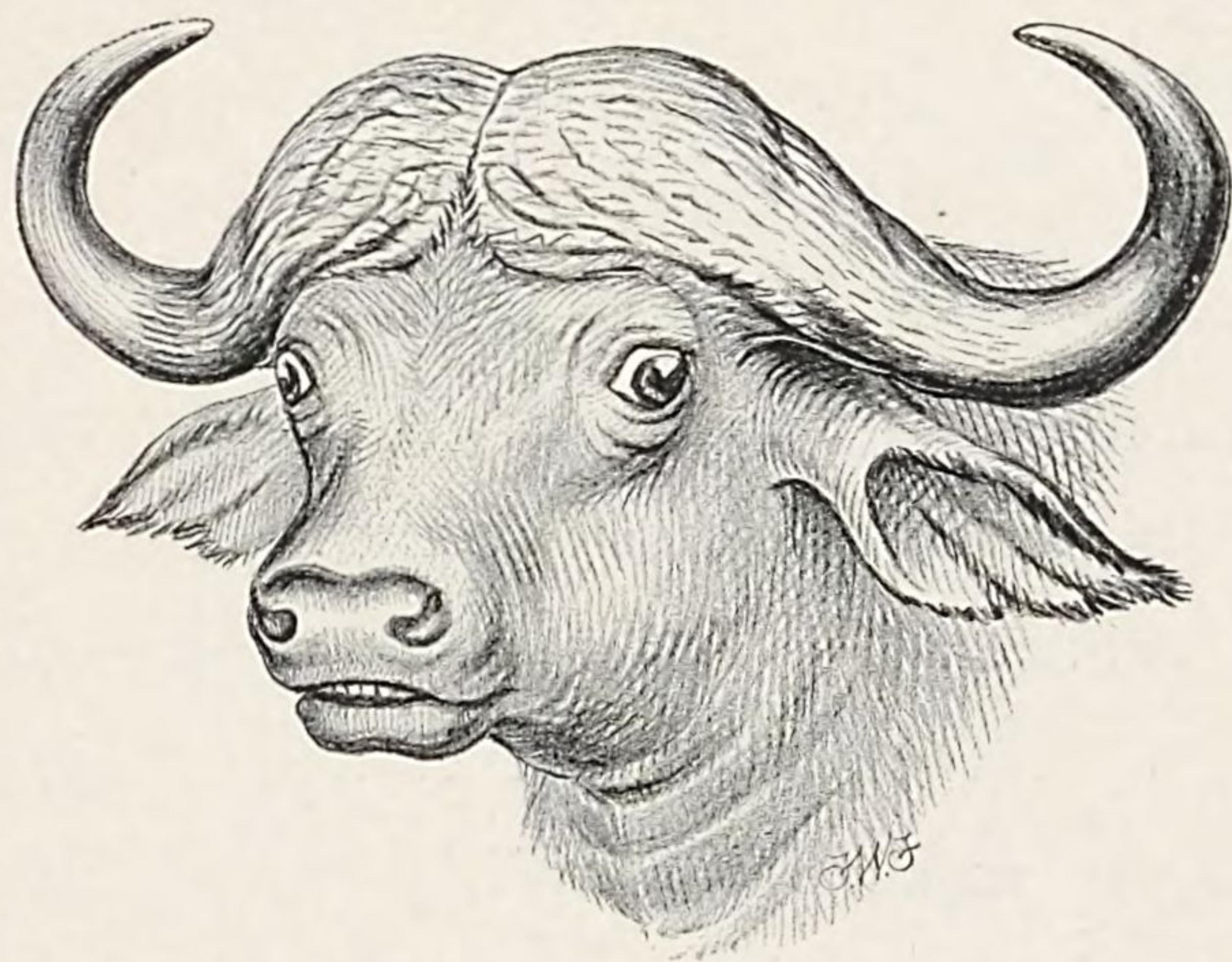


FIG. 17.—Head of Cape Buffalo. (Rowland Ward, *Records of Big Game*.)

Osteol. Mus. Coll. Surg. pt. ii. p. 230 (1884); Pechuel-Loesche, *Zool. Jahrb. Syst.* vol. iii. p. 707 (1888); Bocage, *Journ. Soc. Lisbon*, ser. 2, vol. ii. p. 24 (1890); Pousargues, *Ann. Sci. Nat. Zool.* ser. 7, vol. iv. p. 86 (1897).

Buffelus caffer, Matschie, *Säugeth. deutsch. Öst-Afrika*, p. 107 (1895).

Characters.—Height varying from about 4 feet 10 inches to 3 feet 6 inches at the withers. Head relatively short, with the muzzle very broad, and the nasal bones of the skull short and wide; typically the profile of the forehead deeply concave below the horns, and the forehead itself very convex. Horns very variable, but always black, more or less markedly expanded and flattened at the base, so as to obliterate the distinctly

triangular form ; frequently receding far behind the plane of the eyes, and generally with a distinct demarcation between the rough bases and the smooth tips. Ears very large, heavily fringed with long hairs, especially on the lower margin, and the upper margin sharply truncated before descending to the pointed extremity. Tail tufted, and reaching a little below the hocks. Hair of back directed uniformly backwards, from the neck to the rump ; that of head and body coarse, and in adults more or less sparse, in colour varying from black, through brown, to orange-red or yellow.

Few of the larger mammals have given rise to more confusion than the various forms of African buffalo ; and many more specimens are required before the various points in dispute can be regarded as finally settled. If we had only the enormous black buffalo of the Cape and the little red buffalo of the Congo to deal with, there would be no hesitation in regarding them as perfectly distinct species. But these extreme forms are so intimately connected by intermediate modifications, that it seems impossible to look upon them in any other light than geographical races of a single extremely variable and widely spread species. The brown buffalo of Nubia and Abyssinia, for example, is so close to the Cape animal, that it must almost certainly be regarded merely as a sub-species. And the alliance between the Abyssinian and the Senegambian race seems even closer still. But in colour the Senegambian form approximates to the red Congo buffalo, constituting the other extreme of the series. All the different forms agree in the normal direction of the hair of the back.

As an instance of the diversity of views entertained by naturalists on this question, it may be mentioned that in his first paper on the subject Sir V. Brooke regarded all the West African buffaloes as specifically inseparable from the Abyssinian form, but kept the Cape buffalo distinct. In his second memoir (1875) all three forms were regarded as distinct, but closely allied species. On the other hand, Dr. Pechuel-Loesche makes



CAPE BUFFALO.

the Abyssinian buffalo a race of the Cape species, but keeps the western forms apart as a second species. Any one who compares a skull of the Abyssinian buffalo with the West African specimen described by Dr. Gray as *B. centralis* will scarcely fail to be convinced of the impossibility of maintaining such a distinction.

Distribution.—Africa south of the Sahara.

a. CAPE, OR BLACK RACE—*BOS CAFFER TYPICUS*

Characters.—Size large and build very heavy and clumsy, the height at the shoulder reaching to from 4 feet 10 inches to 5 feet ; skull massive, with the profile immediately below the horns deeply concave. Hair, except on the margins of the ears and at the tip of the tail, where it is long, comparatively scanty in the adult, but thicker in the young ; general colour black, frequently with a reddish tinge, most marked on the legs and in young animals. Horns large and massive, exceeding twice the long diameter of the skull in length ; at first directed mainly outwards, but also dipping boldly downwards and backwards so as to be depressed much behind the plane of the eyes, then curving upwards, forwards, and inwards, but their tips widely separated, and not coming within the lines of the lateral borders of the skull ; their basal anterior surfaces in old bulls raised into huge convex bosses, nearly meeting in the middle line of the forehead ; in cows these basal bosses much less developed, and separated by a broad, hairy space. Although the profile of the head immediately below the horns is markedly concave, that of the lower part of the face is as distinctly convex.

The following are the dimensions of the twelve largest pairs of horns recorded by Mr. Rowland Ward in the 1896 edition of his *Records of Big Game* :—



Greatest Width.		Tip to Tip.	Width of Expansion.	Locality.
Outside.	Inside.			
$49\frac{1}{2}$	$43\frac{3}{8}$	$30\frac{7}{8}$	12	Sabi River
47	41	$28\frac{1}{2}$	12	Limpopo
47	$40\frac{7}{8}$	?	$12\frac{1}{4}$	E. Africa
?	$40\frac{1}{2}$	26	?	„
$46\frac{1}{2}$	$44\frac{1}{4}$	$37\frac{1}{2}$	$6\frac{1}{2}$	Pungwi River
$45\frac{3}{4}$	$41\frac{1}{4}$	$37\frac{1}{8}$	?	S. Africa
$45\frac{3}{4}$	40	$28\frac{3}{4}$	12	Nyasaland
$45\frac{1}{2}$	41	30	?	E. Africa
$45\frac{1}{2}$	?	?	$11\frac{1}{2}$	Kilima-Njaro
45	$39\frac{3}{4}$	$36\frac{1}{2}$	14	E. Africa
45	?	?	?	Nyasaland
$44\frac{3}{4}$	$39\frac{5}{8}$	$27\frac{1}{2}$	$11\frac{1}{4}$	E. Africa

Distribution.—Southern Africa, extending from the Cape to the south bank of the Congo on the west side, and about to the equator (Victoria Nyanza) on the east side of the Continent. In Angola, according to Professor Barboza du Bocage, the Cape buffalo is abundant right up to the Congo, being found both near the coast in the neighbourhood of Mossamedes and on the inland plateau of Quillengues. Since it occurs in the neighbourhood of Mount Kilima-Njaro and the Victoria Nyanza, its distributional area towards the north may be approximately limited by the Nile watershed; but whether in this region it intergrades with the Abyssinian race, or whether the two keep completely apart, I have no information.

In common with most other large African mammals, the buffalo has been greatly reduced in numbers in many of its haunts, from some of which it has been completely exterminated. In the eastern forest districts of the Cape Colony a few herds are preserved by Government protection; and in the impenetrable country in the neighbourhood of Delagoa Bay they are still abundant. In 1892 Messrs. Nicolls and Eglington wrote as follows regarding their distribution in South-Eastern Africa:—“North of the Crocodile, and particularly in the tsetse-fly-infected and low-lying

unhealthy countries through which the Sabi, Gorongosi, Bosi, and Pungwi rivers flow before entering into the Indian Ocean, they are in unfrequented places still quite common, and may be come upon in large herds, being, however, extremely difficult to get at owing to the deadly nature of the climate. Now almost driven out of Mashonaland, a good many herds yet remain in Northern Matabililand, along the tributaries of the Zambesi, as also on both banks of the Chobi, and particularly in the angle formed by these rivers before their junction. Once very common throughout the country about Lake Ngami, they have now almost entirely disappeared from there, and are only occasionally seen in the west along some of the swamps of the Okavango."

Habits.—Like its kindred, the Cape buffalo associates in large herds, and when feeding generally moves in compact bodies almost always led by a cow. Their feeding-grounds, at least in East Africa, are either among open bush, or in clear pasture in the neighbourhood of bush. After feeding during the night and early morning on such ground, they generally seek thick covert for repose during the heat of the day. In undisturbed districts, even when covert is at hand, they will, however, sometimes prefer to lie out in the open during the day, probably to escape the attacks of flies. The old bulls, except during the pairing season, frequently separate from the herd to wander about either alone or in parties of three or four. Such bulls have frequently been stated to be more dangerous than those accompanying the herd, but this is denied by Mr. F. J. Jackson in his article on this species in the *Badminton Library*. As regards the disposition of the animal, it is indeed very difficult to arrive at a satisfactory conclusion, since different sportsmen differ much in their accounts on this subject. Mr. Oswell, for example, in another article in the same volume, gives the Cape buffalo a very bad character indeed, more especially when stalked in thick covert, where it will craftily double back alongside its track, and then suddenly rush out on its unsuspecting pursuer. On the

other hand, Messrs. Nicolls and Eglington state that the reputation of the animal for ferocity has been much exaggerated, and that when disturbed it generally prefers to seek safety in flight rather than to initiate an attack. They admit, however, that on occasions a bull that has not previously been wounded will make an unprovoked charge, even in the open ; and they are in accord with other writers as to the danger of following a wounded bull in thick covert. Mr. Jackson mentions the extreme caution always necessary in buffalo-shooting, and recommends the sportsman to get within such a distance as to ensure killing or disabling his quarry at the first shot. A buffalo when charging rushes forward with its muzzle held nearly straight out and its forehead almost horizontal ; and even when within striking distance the head is not lowered, but turned to one side, and the foe knocked down or gored by a sideways sweep of the massive horns. This attitude is shown in the central figure in the well-known illustration in Livingstone's *Missionary Travels*, although a second individual in the same plate is depicted with the head lowered ; and in all the animals the tail is represented as elevated instead of held straight out.

Like the rhinoceroses, buffaloes are frequently attended by the so-called rhinoceros-birds and egrets, which perch on their broad backs for the purpose of feeding on the insects swarming around them ; and when thus attended they are much more difficult of approach than when alone. Buffalo are seldom if ever found far away from water, and they are in the habit of refreshing themselves with a bath both before and after grazing. The calves, of which but one is produced at a birth, are born in the summer months from January to March ; and for the first few days after their appearance in the world are securely hidden among tall grass by the cows, who at such times separate themselves from the herds to remain in the neighbourhood of their offspring and attend to their periodical wants. During the pairing season frequent fights take place among the old bulls. Next to man, the greatest foe of the buffalo is the lion ; and although a

single lion would probably be unable to pull down unaided an old bull in the prime of his strength, one instance at least is on record where three of the felines have combined forces to effect their object.

b. ABYSSINIAN, OR BROWN RACE—*BOS CAFFER ÆQUINOCTIALIS*

Bubalus caffer æquinoctialis, Blyth, *Proc. Zool. Soc.* 1866, p. 371 ; Pechuel-Loesche, *Zool. Jahrb. Syst.* vol. iii. p. 713, pl. xxvii. (1888).

Bubalus pumilus orientalis, Brooke, *Proc. Zool. Soc.* 1873, p. 483, pl. xlii.

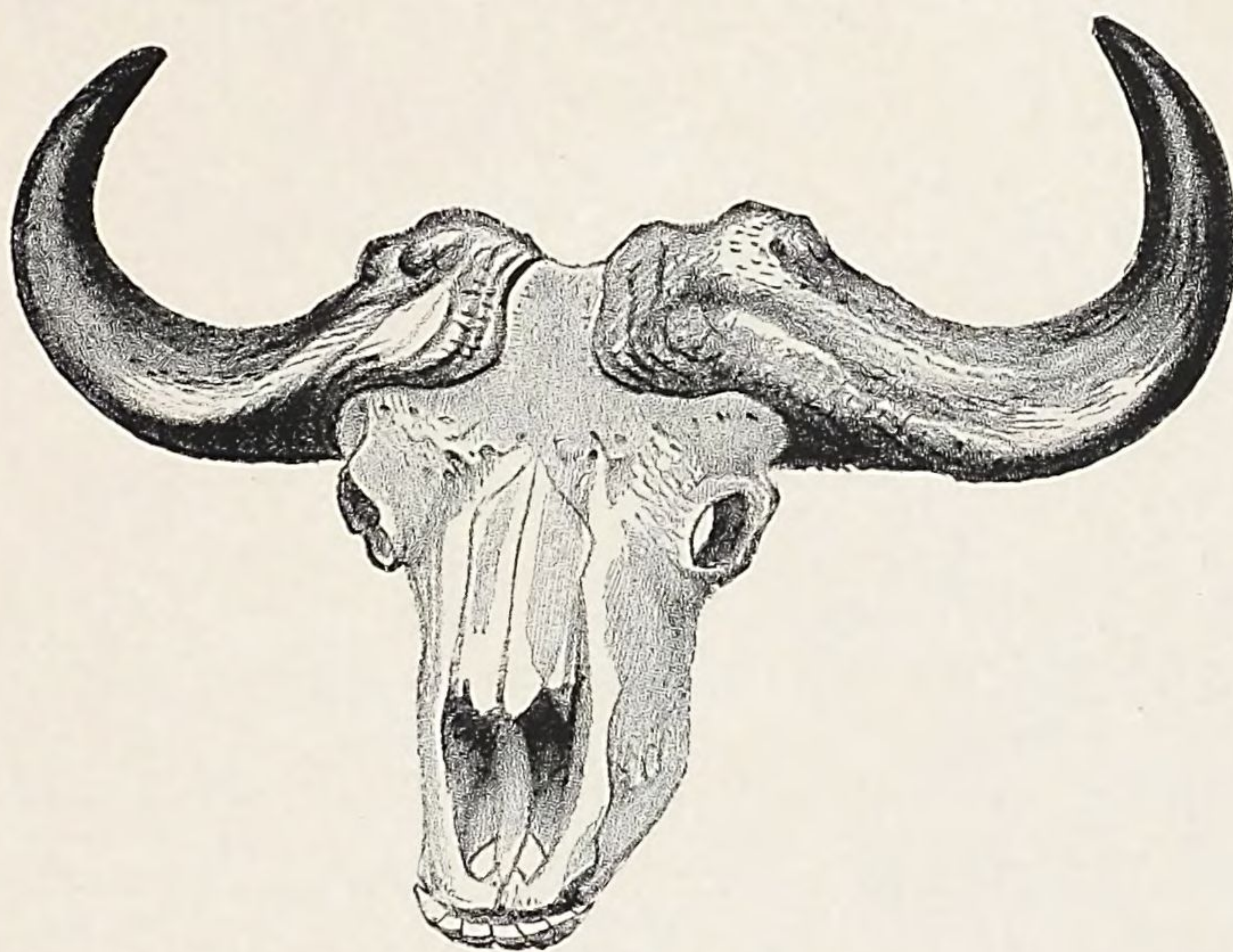


FIG. 18.—Skull and horns of Abyssinian Buffalo. (Rowland Ward, *Records of Big Game*.)

Bubalus æquinoctialis, Brooke, *Proc. Zool. Soc.* 1875, p. 457 ; Pousargues, *Ann. Sci. Nat. Zool.* ser. 7, vol. iv. p. 87 (1897).

Bos æquinoxialis, Huet, *Bull. Soc. Acclim. Paris*, vol. xxxviii. p. 337 (1891).

Bos centralis, Ward, *Records of Big Game*, p. 265 (1896), *nec* Gray, 1872.

Characters.—Size smaller than in the preceding, the height at the shoulder being about 4 feet. Hair coarse, and often somewhat scanty, longest along the ridge of the back and under surface of the head. General colour uniform blackish or tawny-brown, slightly tinged with rufous on the sides

and flanks ; chest and upper part of fore-legs light grayish-brown ; fore-legs from knees downwards blackish-brown ; long hairs on margins of ears brown, longer in the cows than in bulls ; tail-tuft black. Horns of the same general type as in the Cape race, but relatively shorter, not greatly exceeding the skull in length, separated in both sexes, except sometimes on the extreme vertex of the head, by a broad hairy space between their bases, which are very much flattened ; spreading at first almost horizontally outwards, and sometimes retreating less behind the plane of the eyes ; the bases not developed into prominent bosses. Pits on forehead of skull very small and almost concealed by overhanging plates of bone.

Apart from skulls, I am acquainted with this race by a mounted specimen from Abyssinia in the British Museum, by a skeleton from Abyssinia in the same collection, and by the figure of the head of an example formerly living at Berlin given by Sir V. Brooke in plate xlii. of the *Proceedings* of the Zoological Society for the year 1873, under the name of *B. pumilus*. In the British Museum mounted specimen the hair on the body is thicker than I should have inferred to be the case from Sir V. Brooke's description. From *planiceros* the present race appears distinguishable by its darker colour, and the darker brown hairs on the margin of the ears.

The following dimensions of horns are recorded by Mr. Rowland Ward :—

Greatest Width.		Tip to Tip.	Front Surface.	Locality.
Outside.	Inside.			
40	37	32	$11\frac{7}{8}$	Abyssinia
39	$36\frac{1}{2}$	$34\frac{1}{2}$	?	Sudan
36	29	24	?	E. Africa
32	28	22	$6\frac{3}{8}$	Burê Country
$31\frac{3}{4}$	$28\frac{1}{4}$	$25\frac{3}{8}$	$8\frac{1}{2}$	Settiti River
$31\frac{1}{2}$	$26\frac{1}{2}$	$21\frac{1}{4}$	$9\frac{1}{4}$	?
$31\frac{3}{8}$	$26\frac{7}{8}$	$24\frac{3}{8}$	?	Abyssinia
$30\frac{1}{2}$	23	$20\frac{1}{2}$	$8\frac{1}{2}$	Sudan

Distribution.—From Abyssinia and the south of Somaliland through the Sudan for a long distance up the White Nile. The habits of this race are probably not essentially, if in any respect, different from those of its cousin of the Cape.

c. SENEGAMBIAN RACE—*BOS CAFFER PLANICEROS*

Bubalus planiceros, Blyth, *Proc. Zool. Soc.* 1863, p. 157.

Bubalus centralis, Gray, *Cat. Ruminants Brit. Mus.* p. 11 (1872), *Hand-list Ruminants Brit. Mus.* p. 11 (1873); Matschie, *Säugethiere Togogebietes*, p. 19 (1893); Pousargues, *Ann. Sci. Nat. Zool.* ser. 7, vol. iv. p. 87 (1897).

Characters.—The West African representative of the preceding race, to which it is closely allied, and with which it probably intergrades in the central districts of equinoctial Africa, as it also does with the Congo race in the hinterland of Sierra Leone. Size somewhat smaller than in the last race. Horns very similar to those of *æquinoctialis*, but shorter, directed less outwardly (forming an angle of about 45 degrees with the middle line of the skull), receding to a less extent behind the plane of the eyes, and in very old bulls closely approximated at their bases. General colour of adult bulls dark blackish-brown, becoming lighter on the hind-quarters, thighs, and muzzle; limbs coloured like body; no distinct black muzzle; ears black inside, with the marginal fringe moderately developed. Younger bulls, and probably cows, with the hair longer and lighter coloured, assuming a brownish-red tinge on the fore-quarters. Pits on forehead of skull small.

The type of the *Bubalus planiceros* of Blyth is the frontlet and horns of a very old bull, formerly preserved at King's College, London, but now in the British Museum. There is no record as to the place of origin of this specimen, which is shown in the accompanying figure. The points of the horns are so worn as to be blunt and rounded, and the rugosities upon their

surface are mostly abraded. The *Bubalus centralis* of Gray is typified by a skull in the British Museum (No. 65, 3, 30, 1), with the right horn preserved, obtained from some part of West Africa.¹ It belongs to a younger bull, the point of the horn being sharp, and directed backwards. A comparison of these two specimens shows that they certainly belong to the same form; the horns in both being quite different in shape from those of the type of *B. caffer nanus*, and much more like those of *æquinoctialis*.

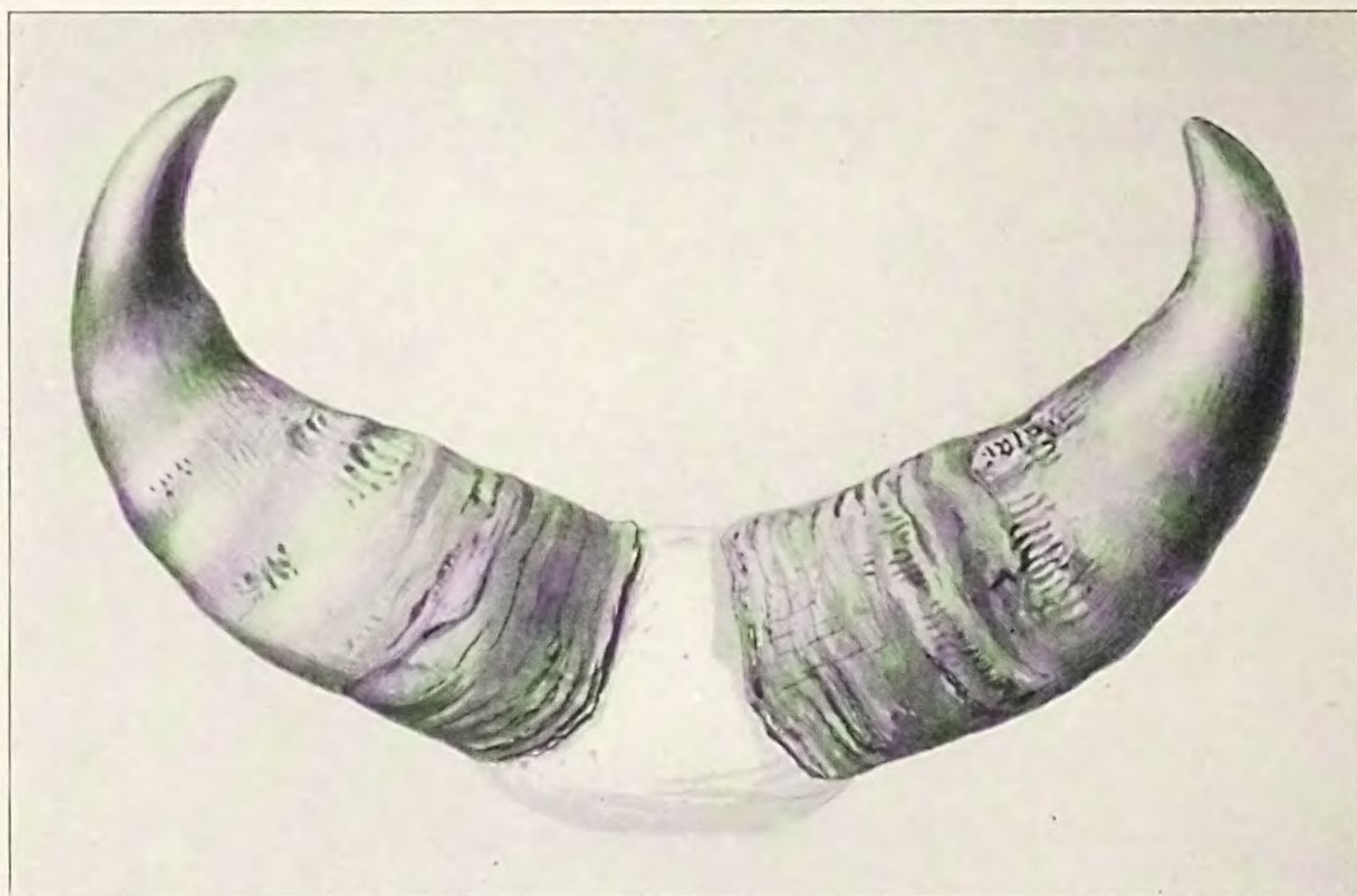


FIG. 19.—Frontlet and horns of aged bull of the Senegambian Buffalo. From the type specimen in the British Museum.

A third pair of horns belonging to an adult (Fig. 20), although not aged, bull, are in the possession of Sir R. B. Llewelyn, the Governor of the Gambia, from which colony they were obtained. They are in a fine state of preservation, with the points sharp and slightly directed backwards; and are important as indicating that the types of *planiceros* and *centralis* were likewise obtained from Senegambia or the adjacent districts.

A young bull from Senegal mounted in the Paris Museum appears likewise referable to the present race, although it is labelled *B. pumilus*. On the fore-quarters the colour of the hair is reddish-brown, but elsewhere

¹ In the *Hand-list* of 1873, erroneously stated to have been collected by Dr. Baikie.

on the body the tint is darker than in *nanus*, while the muzzle and limbs are lighter ; there is no black mane along the neck, and the fringe on the margin of the ears is less elongated, and the whole interior of the ears black. The horns are comparatively small, and from their immaturity present no very distinctive characters.

At the same time, it must be remarked that it is frequently very difficult to distinguish immature examples of this race from specimens of *nanus* from Sierra Leone, where the horns never seem to attain the form



FIG. 20.—Frontlet and horns of male Senegambian Buffalo. From a specimen shot on the Gambia in the possession of Sir R. B. Llewelyn.

characteristic of adult males from the Congo. This is confirmed by Monsieur Pousargues, who remarks that in the Western Sudan and Upper Guinea there occurs a blackish-brown buffalo regarded by some zoologists as a mere variety of *pumilus* (= *nanus*), but by others as a distinct species under the name of *centralis*. That it intergrades both with the northern form of *nanus* and with *planiceros*, I have, as already stated, little doubt ; and if this be so, it certainly cannot rank higher than a sub-species.

Distribution.—The interior of Senegambia, Upper Guinea, and the French Sudan—that is to say, to the north and east of the typical West African forest region.

d. CONGO, OR RED RACE—*BOS CAFFER NANUS*

Bos nanus, Boddaert, *Elenchus Anim.* p. 152 (1785); Ward, *Records of Big Game*, p. 275 (1896), in part.

Bos pumilus, Kerr, *Anim. Kingdom*, p. 340 (1792); Turton, *Transl. Linn. Syst. Nat.* vol. i. p. 121 (1806); Huet, *Bull. Soc. Acclim. Paris*, vol. xxxviii. p. 343 (1891), in part; Flower and Lydekker, *Study of Mammals*, p. 361 (1891); Brehm, *Tierleben,—Säugeth.* vol. iii. p. 319 (1891).



FIG. 21.—Frontlet and horns of aged bull of the Congo Buffalo. From the type specimen in the British Museum.

Bos brachyceros, Pel, *Bijdr. tot Dierkunde*, p. 33 (1854), *nec* Sundevall, 1846.

Bos brachicheros, Du Chaillu, *Explor. Equat. Africa*, p. 210 (1861).

Bubalus reclinis, Blyth, *Proc. Zool. Soc.* 1873, p. 158; Gray, *Cat. Ruminants Brit. Mus.* p. 12 (1872), *Hand-list Ruminants Brit. Mus.* p. 82 (1873).

Bubalus pumilus, Brooke, *Proc. Zool. Soc.* 1873, p. 482, pl. liv., 1875, p. 485, *Ann. Mag. Nat. Hist.* ser. 4, vol. xiii. p. 159 (1874); Flower and



CONGO BUFFALO.

Garson, *Cat. Osteol. Mus. Coll. Surg.* part ii. p. 230 (1884); Pechuel-Loesche, *Zool. Jahrb. Syst.* vol. iii. p. 711, pl. xxviii. figs. 3, 4 (1888); Pousargues, *Ann. Sci. Nat. Zool.* ser. 7, vol. iv. p. 83 (1897).

Bubalus pumilus occidentalis, Brooke, *Proc. Zool. Soc.* 1873, p. 483.

Bubalus brachyceros, Bocage, *J. Soc. Lisbon*, ser. 2, vol. ii. p. 25 (1890); Matschie, *Säugethiere Togogebietes*, p. 19 (1893); *nec* Gray, 1837.

Plate VIII.

Characters.—Size comparatively small and the build light and slender, the height at the shoulder being about 3 feet 6 inches. Forehead of skull nearly flat, without any concavity in the profile below the horns. In fully adult bulls from the Congo the horns closely approximated at their bases, where they are rugose and much expanded and flattened; their direction at first mainly upwards, after which they become smooth and are suddenly bent inwards and backwards, to terminate in long slender tips, which may be very close together, and thus situated directly above the forehead (fig. 21). In younger bulls (fig. 22) less expanded and approximated at the bases, and more widely separated at the tips. In cows the horns are likewise often less flattened and expanded, and more widely separated at the bases and tips; in some specimens from the Congo they are almost cylindrical, and in most examples from Sierra Leone they are widely separated on the forehead and diverge outwardly more in the manner of *centralis*.

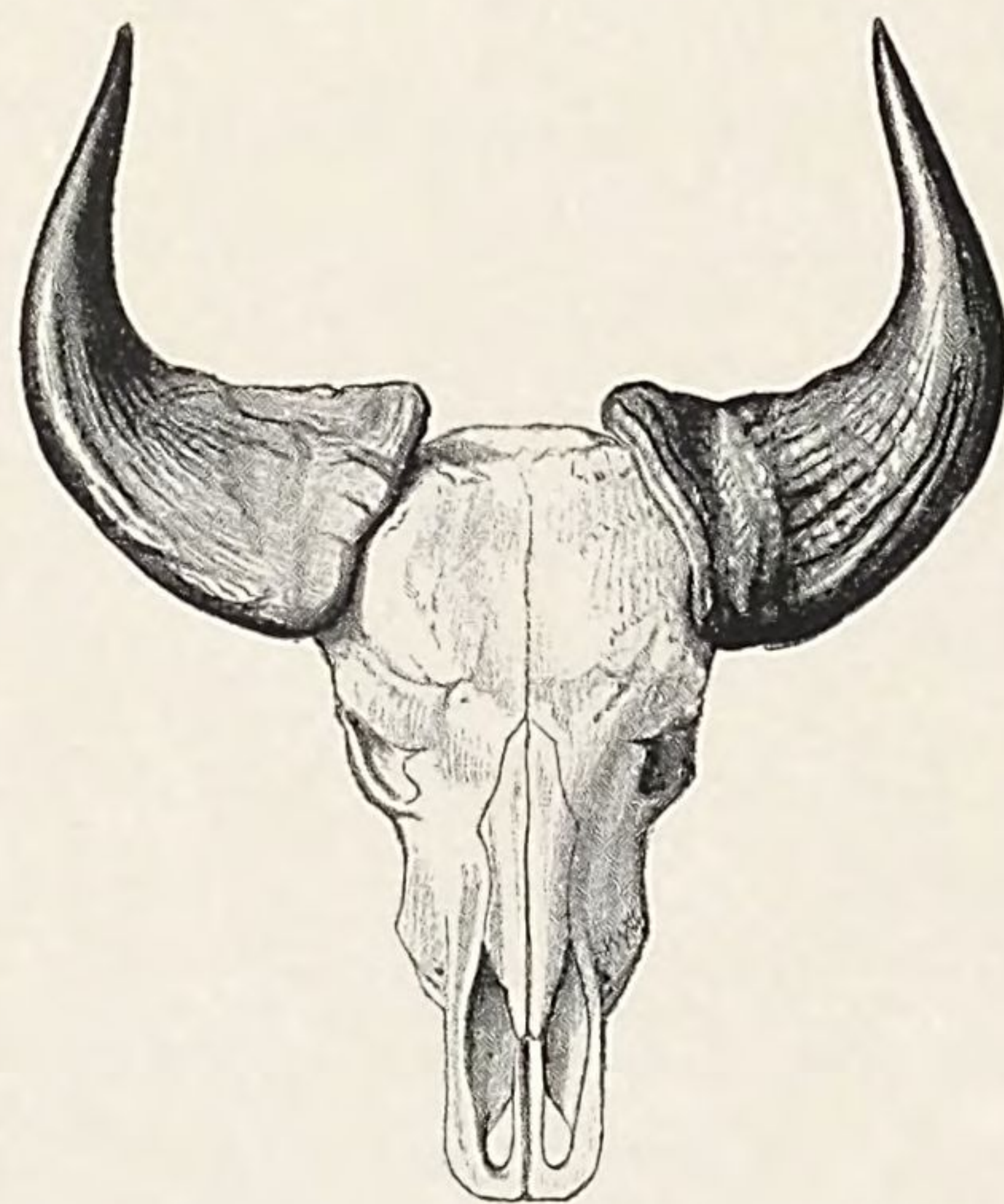


FIG. 22.—Skull and horns of bull Congo Buffalo, from the Niger territory. (Rowland Ward, *Records of Big Game*.)

Hair on the body moderately thick and close, very long on the margins of the ears and the middle line of the neck and back, where it forms

a short mane. General colour of upper-parts bright yellowish or reddish-orange, frequently very similar to that of the bush-pig from the same regions ; long hairs on middle of neck and back and part of those on lower margin of the ears black, as are the legs from above the knees and hocks downwards, and the tuft at the tip of the tail ; on the upper border of the ears the long hairs are pale yellow ; and the interior of the ears, except for a black patch near the lower border, is also yellowish. The pits on the forehead of the skull are very small.

The history of the niare, as this dwarf red buffalo is called at the Gabun, is somewhat curious. The type specimen is the frontlet and horns of an old male (fig. 21), formerly in the possession of the Royal Society of London, but now preserved in the British Museum, where it is the finest specimen representing this race. It was first described as long ago as the year 1686 by Grew in his *Rarities at Gresham College*, and was again described, and also figured, by Pennant¹ in 1771. In 1785 Boddaert named it *Bos nanus*, while Kerr in 1792 and Turton in 1806 gave it the title of *B. pumilus*. In 1852 Dr. Gray figured it as the young of the Cape buffalo ; and in 1863 Mr. Blyth, apparently unaware of the earlier names, redescribed and refigured the same specimen as *B. reclinis*, of which it is also the type.

In 1873, and again in 1875, Sir V. Brooke revived the name *pumilus*, and included under that title all the specimens described as *planiceros* and *brachyceros*. Of the specimens referred to in these memoirs which may be safely assigned to this race, are two skulls in the museum at Leyden brought by Pel from Lower Guinea, which are stated to be very similar to the type, so far as their horns are concerned. Two skulls from the Lower Niger acquired by the British Museum from Dr. Baikie are likewise referable to this form—the one belonging to an adult cow, and the

¹ Gray, *Ann. Mag. Nat. Hist.* ser. 4, vol. xii. p. 499 (1873) ; xiii. p. 258 (1874), considered that *B. pumilus* of Pennant was founded on the dwarf ox of Belon from Morocco ; see Brooke, *op. cit.* vol. xiii. p. 159.

other to an immature animal. An immature skull in the same museum from the Gabun (91, 3, 36, 1) has horns very similar in shape to the type, the tips almost meeting, but smaller and less rugose. The frontlets and horns of a bull and cow from the Congo figured in Dr. Pechuel-Loesche's memoir are almost identical with the type, although the interval between their tips is greater; and Messrs. Rowland Ward recently had a series of specimens of horns of both sexes, probably from the Congo, exhibiting the same form. In a quite young specimen from the Gabun, in the British Museum, the horns are in the form of straight upright spikes. Du Chaillu describes the niare of the Gabun as having horns very similar to those of the type specimen, although they are ill-represented in his figure. In the type specimen the length of the horn along the outer curve is $21\frac{1}{8}$ inches, the basal circumference $12\frac{3}{4}$ inches, and the interval between the tips of the two $2\frac{1}{4}$ inches.

The British Museum possesses the mounted skin of an immature cow of this buffalo shot by Major A. J. Arnold in the Niger territory; two skins have been described by Sir V. Brooke, and there are two others in the Paris Museum. Of the latter, the first is an adult cow from Sierra Leone which was living in the Jardin des Plantes about the year 1844. Although the hair has been almost entirely worn off, sufficient remains to show that the general colour was yellowish-orange, with a black muzzle and legs. The horns are broad and flat at the base, with the tips incurved, but not forming a sudden bend. The second is an immature bull brought from the Congo by M. Dybowski; the general colour is light yellowish-orange, with the hinder part of the inner margin of the ears, the mane on the neck and withers, the tail-tuft, and lower portion of the legs black. The horns are small, and show no incurving at the tips, indicating immaturity.

Of the specimens referred to in Sir V. Brooke's memoir of 1873, one is a cow from Sierra Leone, formerly living in the Surrey Zoological Gardens, and of which a sketch is preserved in the Library of the Zoological

Society. The second is likewise a cow from Sierra Leone, which was living in the Zoological Gardens at Antwerp in 1875, and is figured (together with the head of an immature bull) by Sir V. Brooke in the *Proceedings* of the Zoological Society for the year 1875. The general colour is described as bright yellow. On the shoulders and anterior parts of the body there is a strong tinge of brown, caused by an intermixture of brown and yellow hairs. On the flanks and belly the yellow shades gradually into deep rufous. Upper-parts and sides of the head and neck pure yellow, lower surface of head and neck paler. Entire upper and lower lip, fore-legs from above the knee, and hind-limbs from the hock downwards black. Hair on the upper rim of the inside of the ear yellow, on the lower rim and tip black; as is also the tail-tuft. The horns are widely separated on the forehead, and directed to a considerable extent outwards at first starting, and have no sudden inward bend at the tips, being apparently not unlike some specimens of *planiceros*. The animal was, however, not an aged one, being only about three years old;¹ and it is possible that if its life had been prolonged the horns might have approximated at their tips.

In the British Museum mounted female from Nigeria the horns are of a somewhat similar type, being well flattened at the base but not bent in at their tips. This animal was, however, still younger than the last, all the milk-teeth except the first pair of incisors being retained, so that the immaturity question again comes in; but it is noticeable that in a series of horns from the same district sent home by Major Arnold (one of which is shown in fig. 22) none exhibit the marked inbending of the typical Congo form. The same is also the case with the Togo specimens figured by Dr. Matschie. The hair in the British Museum specimen is very sparse, and less red than in many other examples. The height at the shoulder is 3 feet 8 inches.

¹ All the milk-teeth had been replaced shortly before its death.

Of four skulls obtained from the Congo by M. Dybowski and preserved in the Paris Museum, two are those of males and two of females. The horns of the adult bull are strongly convergent, and much resemble the type pair, but those of the second and younger bull are not distinctly convergent at the tips. The horns of one of the female skulls are of nearly similar curvature to those of the adult male, but much thinner, and nearly cylindrical, while those of the second are more expanded and flattened.

Specimens are urgently needed before the variations according to age, sex, and locality of the horns of this race can be fully worked out ; but it appears to be the case that horns precisely comparable to those of the type specimen are to be met with only in the Congo and perhaps Lower Guinea, and that as we advance towards Sierra Leone these appendages apparently tend to become more divergent, and consequently more like those of the Senegambian race. Hence it may be inferred that the type specimen was in all probability obtained somewhere between the Congo and the mouth of the Niger.

The leading characteristics of the race are to be found in the general yellow coloration, the yellow inner surface of the ear, save for a black patch on the lower margin, and the black muzzle, mane, tail-tuft, and legs. Taken by itself, there would be no question that the Congo buffalo should be regarded as specifically distinct from its gigantic black relative of the Cape ; but it appears in the northern part of its range to pass imperceptibly into the larger variety *planiceros*, which again is closely allied to the still larger *æquinotialis* ; while the latter in turn in East Central Africa not improbably passes into the typical Cape form.

It has been remarked that blackness in animals is very generally associated with hot damp climates ; but it is evident that the Congo buffalo forms an exception in this respect, the allied race inhabiting the open plains of the Cape being black, while redness is characteristic of the

Western race. An analogous instance is afforded by the bush-pigs, of which the West African species is red, while the southern one is dull grizzled brown.

Distribution.—The West African forest region, extending from the north bank of the Congo, through the Gabun, Lower Guinea, Togo, Ashanti, and Liberia to the coast districts of Sierra Leone; in the interior stated to extend up the Congo valley as far as Stanley Falls.

Habits.—The Congo buffalo is described as being very shy and difficult to approach, for which reason, as well as on account of the unhealthy nature of the climate of most of its habitat, but little is known of its mode of life. They apparently prefer districts covered with thick bush, especially narrow valleys, to more open country; and in such covert remain concealed during the hottest part of the day. Hills of about a thousand feet in height are their favourite resorts, and from these they descend before daylight to drink, after which they gradually make their way up again, feeding as they go. Although at times associating in herds, it is stated that they are more commonly found in pairs, or even solitary. Although harmless when undisturbed, native reports say they are given to charge when wounded, and the experience of Major Arnold points to the probability of this being correct.

e. LAKE TCHAD RACE—*BOS CAFFER BRACHYCEROS*

Bubalus brachyceros, Gray, *Mag. Nat. Hist.* vol. i. p. 587 (1837), *List Mamm. Brit. Mus.* p. 153 (1843), *Ann. Mag. Nat. Hist.* ser. 4, vol. xii. p. 499 (1873), xiii. p. 258 (1874), *Cat. Ungulata Brit. Mus.* p. 24 (1852), *Cat. Ruminants Brit. Mus.* p. 10 (1872), *Hand-list Ruminants Brit. Mus.* p. 81 (1873); Blyth, *Proc. Zool. Soc.* 1863, p. 157.

Bos brachyceros, Sundevall, *K. Svenska Vet. Ak. Handl.* for 1844, p. 153 (1846).

Bubalus pumilus, Brooke, *Proc. Zool. Soc.* 1873, p. 482, 1875, p. 455, in part.

(?) "Gray Buffalo," Pechuel-Loesche, *Zool. Jahrb. Syst.* vol. iii. p. 721, pl. xxviii. fig. 5 (1888).

Characters.—Horns of adult bull less flattened and less approximated at their bases than in the typical Congo form of *nanus*, with the smooth tips shorter and curving markedly forwards so as to overhang the forehead, which is flattened. In the cow the horns are sub-cylindrical, curving regularly upwards and inwards, without any sudden angulation or forward inclination. Pits on the forehead of the skull very large. Colour not definitely known, but not improbably gray.

This form, which is provisionally allowed sub-specific rank, is typified by two skulls with horns obtained by Captain Clapperton and Colonel Denham¹ from the neighbourhood of Lake Tchad and preserved in the British Museum; the larger of these being figured by Sir V. Brooke in the *Proceedings* of the Zoological Society for the year 1873, p. 478, as the female of *B. pumilus*. Both specimens were indeed regarded by Sir Victor as referable to the female of the Congo race, but there is such a marked difference between them that it appears most probable that whereas one (the figured example) indicates a bull, the other belonged to a cow. Moreover, the presumed male horns, in their forward inclination, are unlike any specimens I have seen that can be definitely assigned to *nanus*; while the large pits in the forehead of the skull are not observable in the latter. The circumstance that Lake Tchad lies beyond the limits of the typical West African forest region, and possesses a different fauna, including giraffes, should likewise not be omitted from consideration. From all these circumstances taken together there seems a considerable degree of probability that the Lake Tchad buffalo represents a race by itself, although additional

¹ *Narrative of Travels and Discoveries in Northern and Central Africa, in the Years 1822, '23, and '24*, by Major Denham, Capt. Clapperton, and Dr. Oudney, maps and plates, 2 vols. 8vo (1826).

specimens are essential before the point can be regarded as settled. Not impossibly the skull or a female buffalo with a gray pelage figured by Dr. Pechuel-Loesche in the memoir cited above, may prove to belong to the present form. Unfortunately, the exact locality whence that specimen was obtained is unknown.



FIG. 23.—Skull and horns of ~~male~~ Lake Tchad Buffalo. From the type specimen in the British Museum.

In the presumed male the horns have a length of $18\frac{1}{4}$ inches along the outer curve, with a basal circumference of $10\frac{3}{4}$ inches, and an interval of $5\frac{1}{2}$ inches between the tips. In the presumed female¹ the corresponding dimensions are 17, $11\frac{3}{8}$, and $6\frac{3}{4}$ inches.

¹ In the *Records of Big Game*, p. 275, Mr. Rowland Ward takes the same view as to the sexes of these two skulls.

Distribution.—The neighbourhood of Lake Tchad, situated in West Central Africa due north-east of the Gulf of Guinea.

2. THE ALGERIAN BUFFALO—*BOS ANTIQUUS* (*Extinct*)

Bubalus antiquus, Duvernoy, *C. R. Acad. Paris*, vol. xxxiii. p. 595 (1851); Gervais, *Zool. et Pal. Générales*, ser. 1, p. 93, pl. xix. (1867-69); Rüttimeyer, *Abhandl. schweiz. pal. Ges.* vol. v. p. 145 (1878); P. Thomas, *Bull. Soc. Zool. France*, 1881, p. 30, pl. ii.; Lydekker, *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 29 (1885); Pomel, *Carte Géol. d'Algerie—Pal. Mon. Les Bubalides* (1893).

Bubalus baini, Seeley, *Geol. Mag.* decade 3, vol. viii. p. 192 (1891).

Bos antiquus, Lydekker, *Horns and Hoofs*, p. 45 (1893).

Characters.—A gigantic species with the nasal bones of the comparatively short type distinctive of the existing African buffalo, but with the rims of the sockets of the eyes much less prominent than in the Cape race, and the horn-cores (fig. 2, p. 21), which are of enormous extent, widely separated on the forehead, and with a curvature not unlike that of the Cape and north-eastern races of the living African species. In their downward curvature at the base, and comparatively slight angulation for the greater part of their length the horn-cores come decidedly nearer to the African than to the Indian buffalo; and the slight prominence of the orbits is only an exaggeration of a characteristic feature of the former, which is most apparent in the smaller races. Specimens have been described, measuring at least 11 feet along the curve of the horn-cores, and in one example the same measurement has been estimated at 14 feet. In addition to this, the length of the portions of the horns themselves covering the tips of the horn-cores has to be taken into account.

Remains of this magnificent buffalo occur typically in the superficial deposits of Algeria, but skulls from the corresponding formations of the Cape,

described under the name of *B. baini*, are apparently specifically indistinguishable. Rude sculptures on rock-faces indicate that in Algeria the species was coexistent with man. Regarding its affinities, the observations of Monsieur P. Thomas are significant. He writes that, apart from certain differences, nothing is more like the skull of this species than one of the Indian buffalo; but, on the other hand, the body-skeleton comes much closer to that of the Cape species. If a very large arni skull were affixed to the skeleton of a Cape buffalo, we should have an animal very like the fossil. Monsieur Pomel is of opinion that the present species is equally distinct from both the African and the Indian buffalo.

The resemblance to the Indian buffalo, in my own opinion, is probably largely due to the excessive development of the horns, and therefore superficial; and I think it is much nearer to the African species, of which indeed it may not improbably be regarded as the ancestral form. It is important to observe that its horn-cores are much more like those of the Abyssinian than those of the Cape race of the modern African species, from which it may be inferred that the helmet-like mass formed by the horns on the forehead of the latter is a specialised feature of late origin. Not less noteworthy is the greatly inferior length of the horns in all the races of the living species. At the same time, seeing that many African mammals appear to have been derived from extinct Indian types, the present species may have retained some indications of affinity with the Indian buffalo.

Distribution.—Africa during the Prehistoric and Plistocene periods, ranging from Algeria to the Cape.

3. THE SIWALIK BUFFALO—*BOS PLATYCEROS* (*Extinct*)

Bubalus platyceros, Lydekker, *Rec. Geol. Surv. Ind.* vol. x. p. 31 (1877), *Pal. Ind.* (*Mem. Geol. Surv. Ind.*), ser. 10, vol. i. p. 127, pl. xviii. (1878), *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 29 (1885).

Bubalus sivalensis, Rütimeyer, *Abh. schweiz. pal. Ges.* vol. v. p. 138 (1878).

Characters.—Allied to the Indian buffalo, but with the forehead nearly flat, and the horn-cores, which are perfectly triangular in section, more widely separated at their bases, set much more obliquely on the forehead, situated more in advance of the plane of the occiput, and with their front face in



FIG. 24.—Restored skull of the Siwalik Buffalo.

the plane of the forehead. The horn-cores tapering regularly and rapidly, and directed upwards, outwards, and somewhat inwards, in a symmetrical curve. In correlation with the position of the horn-cores, the occipital surface of the skull is more distinct from the ridge between the horn-cores than is the case in the living Indian buffalo. The approximate span of the horn-cores in the type specimen is 29 inches.

This well-marked species is represented by a somewhat imperfect skull in the Indian Museum, Calcutta (fig. 24), and a still more imperfect one in the British Museum.

In the flattened forehead, as well as in the position and setting-on of the horn-cores, this species makes a decided approach to the anoa and its extinct allies, which it thus serves to connect with the Indian buffalo.

Distribution.—India during the Pliocene period. The known remains occur in the Siwalik Hills, extending from the Simla district to the Punjab, but the species probably had a wider range than these limits.

4. THE INDIAN BUFFALO—*BOS BUBALIS*

Bos bubalis, Linn. *Syst. Nat.* ed. 12, vol. i. p. 99 (1766).

Bos bubalus, Gmelin, *Syst. Nat.* vol. i. p. 206 (1788); H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 392 (1827); Hutton, *Journ. As. Soc. Bengal*, vol. xv. p. 142 (1846); Sundevall, *K. Svenska Vet. Ak. Handl.* for 1844, p. 153 (1846); W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 129 (1891); Blanford, *Fauna Brit. India—Mamm.* p. 491 (1891); Hose, *Mammals of Borneo*, p. 64 (1893); Ward, *Records of Big Game*, p. 266 (1896).

Bos arnee, Kerr, Linn.'s *Animal Kingdom*, p. 336 (1792); Gray, *Proc. Zool. Soc.* 1855, p. 17, pl. xi.

Bos buffelus, Blumenbach, *Handbuch Naturgeschichte*, ed. 10, p. 121 (1821); Flower and Lydekker, *Study of Mammals*, p. 361 (1891).

Bos arni, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 388 (1827); Sundevall, *K. Svenska Vet. Ak. Handl.* for 1844, p. 153 (1846).

Bos (Bubalus) arnee, H. Smith, *op. cit.* vol. v. p. 372 (1827).

Bos (Bubalus) bubalus, H. Smith, *loc. cit.* (1827).

Bubalus arnee, Jardine, *Naturalist's Library—Mamm.* vol. iv. p. 243 (1836); Cantor, *Journ. As. Soc. Bengal*, vol. xv. p. 273 (1846).

Bubalus arna, Hodgson, *Journ. As. Soc. Bengal*, vol. x. pp. 469 and 921 (1841), xvi. p. 709 (1847); Horsfield, *Cat. E. Ind. Mus.* p. 179 (1851).

Bubalus buffelus, Gray, *List Mamm. Brit. Mus.* p. 152 (1843), *Cat.*



INDIAN BUFFALO.

Ungulata Brit. Mus. p. 25 (1852), *Cat. Ruminants Brit. Mus.* p. 9 (1872); Kelaart, *Prodromus Fauna Zeylan.* p. 87 (1852); Flower and Garson, *Cat. Osteol. Mus. Coll. Surg.* pt. ii. p. 229 (1884); Lydekker, *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 28 (1885); Huet, *Bull. Soc. Acclim. Paris*, vol. xxxviii. p. 7 (1891).

Bos kerabau, Sundevall, *K. Svenska Vet. Ak. Handl.* for 1844, p. 153 (1846).



FIG. 25.—Head of male Indian Buffalo. From a specimen killed by the Maharaja of Kuch Behar. (Rowland Ward, *Records of Big Game.*)

Buffelus indicus, Rütimeyer, *Verh. Ges. Basel*, ser. 2, vol. iv. p. 334 (1865), *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 52 (1867), *Abh. schweiz. pal. Ges.* vol. v. p. 189 (1878).

Bubalus indicus, Rütimeyer, *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 32 (1867); Steere, *Proc. Zool. Soc.* 1888, p. 415.

Buffelus sondaicus, Rütimeyer, *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 52 (1867), *Abh. schweiz. pal. Ges.* vol. v. p. 189 (1878), no description, nec *Bos sondaicus*, Müller and Schlegel, 1840.

Bubalus arni, Jerdon, *Mamm. Ind.* p. 307 (1867); Sterndale, *Mamm. Ind.* p. 490 (1884).

Bos (Bubalus) buffelus, Blanford, *Journ. As. Soc. Bengal*, vol. xxxvi. p. 195 (1867).

Bubalus kerabau, Brehm, *Tierleben—Säugethiere*, vol. iii. p. 327 (1891).

Bubalus bubalus, Meyer, *Abh. Mus. Dresden* for 1896-97, No. 8, p. 14 (1896).

Plate IX

Characters.—Size typically very large, the height at the shoulder varying from 5 feet to as much as 6 feet 2 inches in adult bulls. Head relatively long, with the muzzle moderately broad, and the nasal bones of the skull elongated; the profile of the whole head nearly straight, and the convexity of the forehead moderate. Horns black, very long, distinctly triangular, tapering regularly from base to tip, with irregular transverse ridges and grooves for the greater part of their length; their bases widely separated, and their curvature not varying much from one plane, although typically there is a distinct recession behind the plane of the centre of the forehead; typically the curvature is upwards, outwards, and slightly backwards, markedly increasing towards the tips, where the direction is inwards and slightly forwards. In some examples of the typical race the horns are, however, directed almost outwards till near their tips, when they are curved suddenly upwards. Those of cows longer and more slender than in bulls. Ears comparatively small and tubular, without heavy fringes of long hair on their margins. Tail reaching about to the hocks, with a small terminal tuft. Hair coarse and sparse, nearly disappearing in the adult; that on the middle line of the back reversed, so as to be directed forwards from the haunches to the occiput, and forming a whorl in front of the pelvis; the colour varying from ashy blackish-gray to dun, the legs sometimes dirty white, more especially in the domesticated race.

It is somewhat remarkable that all the existing species of Asiatic buffaloes are at once distinguished from their African cousins by the reversal of the

hair on the middle line of the back. They likewise differ by the form of the skull and horns, and although these display a considerable degree of variation in the different forms, yet they are essentially of the same type, and present a more or less complete passage from one variety to another. The Asiatic buffaloes seem, therefore, to form a closely allied group of species, which, owing to their isolated habitats, have become more differentiated from one another than have the races of the African buffalo.

Distribution.—In the wild state, India and apparently other parts of the Oriental region.

a. TYPICAL RACE—*BOS BUBALIS TYPICUS*

Characters.—Generally those given above, the horns being large and distinctly receding from the plane of the forehead, and the colour ashy blackish-gray, with or without whitish on the legs below the knees and hocks; lower lip whitish. Forehead moderately convex, and facial portion of skull long.

Although the older writers, like Brian Hodgson, stated that old bulls of the Indian buffalo stood as much as $6\frac{1}{2}$ feet at the shoulder, such dimensions were doubted by Colonel A. Kinloch, who suggested about 5 feet 4 inches as the maximum height. A bull shot by H.H. the Maharaja of Kuch Behar measured, however, 6 feet $2\frac{1}{2}$ inches at the shoulder, with a length of 14 feet 2 inches from the tip of the muzzle to the root of the tail, and a maximum girth of 10 feet 8 inches, that at the shoulder being 2 feet less. As it is unlikely that this specimen was the largest that ever lived, Hodgson's measurements are probably but little, if at all, in excess of the truth. A second bull killed by the Maharaja stood 5 feet 10 inches at the shoulder. There is no evidence that the specimens with outwardly directed horns inhabit an area apart from those with more regularly curved horns, so that the two types cannot be regarded as

indicating separate sub-species. The following dimensions of horns are recorded by Mr. Rowland Ward; some of the specimens from Assam possibly belonging to the next race:—

Length along Outer Curve.	Basal Girth.	Tip to Tip.	Widest Inside.	Sex.	Locality.
$77\frac{3}{8}$	$17\frac{7}{8}$	?	?	?	?
$70\frac{1}{2}$	18	64	78	Female	Assam
$65\frac{3}{4}$	$20\frac{1}{4}$	?	?	?	„
$64\frac{1}{2}$	18	$42\frac{1}{2}$	66	Female	„
63	18	?	60	Male	„
62	$17\frac{3}{4}$	101	?	?	„
$61\frac{7}{8}$	$15\frac{3}{4}$	$22\frac{1}{5}$	$45\frac{1}{4}$	?	Kuch Behar
$61\frac{1}{2}$	16	22	48	Male	Assam
58	15	$46\frac{1}{2}$	59	Female	„
57	$18\frac{1}{2}$	$41\frac{1}{2}$	60	?	Central Provinces
57	15	49	52	?	Assam
56	$19\frac{1}{4}$	$33\frac{7}{8}$	$50\frac{1}{4}$	Female	Kuch Behar
56	$15\frac{1}{2}$	$55\frac{1}{2}$	58	?	„
$55\frac{1}{2}$	$18\frac{1}{2}$	29	44	?	?
$54\frac{1}{2}$	$18\frac{1}{8}$	$38\frac{1}{4}$	$48\frac{7}{8}$	?	?

Distribution.—In a wild state, India, throughout the plains of the Bramaputra and Ganges valleys from the eastern end of Assam to Tirhut, the Terai as far west as Rohilcund, the plains in the neighbourhood of the coast in Midnapur and Orissa, as well as the plains in the Eastern Central Provinces, including the districts of Mandla, Raipur, Sambalpur, Bastar, etc., at least as far south as the valleys of the Godaveri and Pranhita; also the northern parts of Ceylon. In Burma and the Malay Peninsula and Islands (inclusive of the Philippines and Celebes) buffaloes are found indistinguishable from the present race, and some of which are now in a wild condition. Whether, however, they have reverted to this state from domesticity, or whether they are indigenous inhabitants of the country they occur, is a moot point. Some of them have the legs whitish as far as just above the knees and hocks, but a similar condition obtains in many of

the domesticated buffaloes of India. The *Bos kerabau* appears to have been named on buffaloes of this type from the Malayan Islands which, judging from the figure given by Brehm, can in no wise be distinguished from the present race. In a half-wild domesticated condition buffaloes are now met with in Italy, Hungary, Turkey, Egypt, Algeria, and all Western Asia as far as Afghanistan. It is generally considered that these European and North African buffaloes have been introduced from India or other Oriental countries, but it should be remembered that there is a Plistocene European form to which it is just possible their ancestry may be traceable.

Habits.—In India the wild bull buffalo is properly known as the arna, and the female as the arni ; but the animal is very commonly spoken of as jangli bhains, or wild buffalo, bhains being the Hindustani term for the domesticated breed. Other dialects have different titles for the wild race, to which it will be unnecessary to allude on this occasion. Wild buffaloes generally go about in herds of considerable size, and, like the domestic breed, always carry their heads very low. The near neighbourhood of pools or lagoons of water, in the mud of which they can wallow when so disposed, is essential to their existence. They are consequently generally found near swamps, and never frequent hilly ground. Brakes of reeds, or the tallest and thickest grass-jungles are indeed their favourite haunts, although they may occasionally be met with on plains covered with low bushes or short grass, but it is very rarely, if ever, that they are met with in true forest. Grass constitutes their chief nutriment ; and, like most members of their tribe, their feeding-times are the early morning and evening. During the heat of the day they sleep much, and it is said that a bull buffalo if roused from his midday slumber by beating with elephants is much more prone to charge than is one stalked on foot while feeding. Doubtless this is largely due to surprise and fear, for it is a well-known fact that the more suddenly a wild animal is roused the more likely is it to prove dangerous. It, so to speak, loses its head, and cannot

collect its thoughts sufficiently to seek safety in flight. General Kinloch states that he has known bull buffalo to charge elephants both when wounded and before being hit. When they have once decided to attack, they generally charge home; and a beast with horns like the larger specimens in the British Museum must be difficult indeed to avoid. For hunting on foot the best time is in the hot season during the months of April and May, when much of the tall grass has either been burnt or dried up and water is scarce. Fresh tracks in the neighbourhood of pools should then be looked for, and when discovered followed up.

So fond are these buffaloes of water that, both in the wild and domesticated condition, they will frequently stand for hours with only their heads above the surface. In disposition they are somewhat sluggish animals, and show but little fear of man even when in the wild state. Indeed, much damage is done to crops by wild buffaloes in districts where they are common. The innate ferocity of the wild race is well illustrated by an anecdote told by Captain Lamb, who states that on one occasion a bull buffalo that dropped to his rifle was immediately attacked by a second and larger bull, which rolled the wounded animal over and over each time it attempted to regain its legs. Eventually the pair were bagged by the lucky sportsman.

Both in the wild and tame condition the pairing season takes place in autumn, and the young, which may be either one or two in number, are born the following summer, after a gestation of about ten months. Domesticated buffaloes, which are frequently but half-tamed, differ chiefly from the wild race by their inferior bodily size and smaller horns. And although pale-coloured, or even albino varieties may not unfrequently be observed, no distinct tame breeds have ever been produced. Neither will they ever interbreed with the Indian or European domestic cattle.

Regarding the date of introduction of the Indian buffalo into Egypt there appears to be no definite information, but it seems to have been

subsequent to the period of the ancient frescoes, in which the animal is not represented. Although at the present day it may be seen wallowing in the swamps of the Jordan valley as commonly as in those of the Ganges, Canon Tristram states that it does not appear to have been known to the ancient Israelites, and was probably introduced into Palestine at a later period. To Italy, according to the testimony of a contemporary monk, they were introduced about the year 600, in the reign of the Longobardian King Agilulf. Regarding their place of origin, Messrs. Hehn and Stallybrass¹ write as follows:—"It seems probable, as they appear in company with wild horses, that they were a present to the Longobardian kings from the Khan of the Avars, for this Turkish race of nomads, who at that time dwelt near the Danube and scourged the Roman Empire with fearful devastations, were on friendly terms with the Longobardian court. If King Agilulf sent shipbuilders to the Avarian Khan to supply the vessels necessary to taking an island in Thrace, that Khan may well have sent presents from the heart of Asia in return."

Regarding the occurrence of the Indian buffalo in a semi-wild state in Tunisia, Sir H. Johnston writes as follows:—"In the district of Mater in Northern Tunis there is a rather remarkable herd of buffaloes, about fifty in number. They are said to be descended from a few domestic buffaloes of the Indian species presented forty years ago or more by a King of Naples to the Bey of Tunis. They were placed on a property of the Bey's where there is a large swampy lake, in the middle of which rises a mountainous island. Here they have resumed the feral state, and, judging from several heads I have seen, are developing much longer horns than those of the domestic buffalo of Italy."

Domesticated buffaloes are kept chiefly for agricultural labour and as beasts of burden, and also for their milk, which is richer than that of the cow, although somewhat ropy in consistence.

¹ *The Wanderings of Plants and Animals*, London, 1885.

b. UPPER ASSAM RACE—*BOS BUBALIS FULVUS*

Bos bubalus fulvus, Blanford, *Fauna Brit. India—Mamm.* p. 492 (1891).

Characters.—Distinguished from the typical race by its uniformly dull colour, the more convex forehead, and the shorter facial portion of the skull. The race is definitely known by a mounted head in the Indian Museum, Calcutta, and by a skull and horns presented by Mr. A. O. Hume to the British Museum.

Distribution.—The upper districts of the Assam valley.

c. BORNEAN RACE—*BOS BUBALIS HOSEI*

Characters.—Size small, the height at the shoulder being about 3 feet $8\frac{1}{2}$ inches, with relatively short horns, which are continuous with the plane of the forehead, without any backward curvature. General colour ashy-black; the lower lip, a narrow gorget on the throat, the fore-legs from above the knees downwards, the front of the thighs and of hind legs below hocks, except for a triangular patch on the fetlocks, dirty white.

This form is represented by a mounted specimen in the British Museum sent by Mr. C. Hose from Borneo, purporting to be that of a wild animal. In point of size and general appearance the specimen is almost exactly intermediate between the typical Indian buffalo and the tamarau; and it agrees with many examples of the latter in the white gorget on the throat. Mr. Hose mentions that buffaloes exist in a wild state on the Miri and Baram rivers, and it is quite as probable that there should be a native race of buffalo in Borneo as in the Philippines. Accordingly, the present form is provisionally reckoned as such. It appears to be a much smaller animal than the so-called *B. kerabau*, which has long horns, no white gorget on the throat, and seems indistinguishable from the domesticated Indian buffalo.

Distribution.—Borneo.

d. NARBADA RACE—*BOS BUBALIS PALÆINDICUS* (*Extinct*)

Bos palæindicus, Falconer, *Cat. Foss. Vert. As. Soc. Bengal*, p. 230 (1859), *Pal. Mem.* vol. i. p. 280, pl. xxii. (1868).

Buffelus palæindicus, Rüttimeyer, *Verh. Ges. Basel*, ser. 2, vol. iv. p. 334 (1865), *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 52 (1867), *Abh. schweiz. pal. Ges.* vol. v. p. 189 (1878).

Bubalus palæindicus, Lydekker, *Pal. Ind. (Mem. Geol. Surv. Ind.)*, ser. 10, vol. i. p. 132, pl. xix. (1878); Rüttimeyer, *Abh. schweiz. pal. Ges.* vol. v. p. 141 (1878).

Bubalus namadicus, Dawkins, *Cave Hunting*, p. 428 (1874), nec *Bos namadicus*, Falconer, 1859.

Bubalus buffelus palæindicus, Lydekker, *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 28 (1885).

Characters.—Very close to the typical race, but of larger dimensions, with a more convex forehead, and the horns apparently always directed to a great extent outwardly. In the horn-cores themselves the transverse section is also somewhat different, tending to become quadrangular, instead of being strictly triangular.

Distribution.—India during the Plistocene period; found typically in the ossiferous gravels of the Narbada river, but also occurring in those of the Godavari and Pem Ganga. Buffalo skulls discovered in the top-most Siwalik rocks of the Punjab probably also belong to the same form.

e. EUROPEAN RACE—*BOS BUBALIS PALLASI* (*Extinct*)

Bos pallasii, Baer, *Foss. Mamm. Prussia*, p. 27 (1823).

Bubalus pallasii, Römer, *Zeitschr. deutsch. geol. Ges.* vol. xxvii. p. 435, pl. xi. (1875); Rüttimeyer, *Verh. Ges. Basel*, vol. vi. p. 320 (1875), *Abh. schweiz. pal. Ges.* vol. v. p. 143 (1878).

Characters.—Apparently distinguishable from the Narbada buffalo merely by its somewhat inferior dimensions.

Distribution.—Central and Southern Europe during the Plistocene period. This form is typified by an imperfect skull from Dantzig, where a second and smaller skull was subsequently discovered. Additional remains have been recorded by Professor Rüttimeyer from the pre-glacial deposits near Rome and other districts in Italy.

5. THE TAMARAU, OR MINDORO BUFFALO—*BOS MINDORENSIS*

Bubalus mindorensis, Heude, *Mem. Hist. Nat. Emp. Chinois*, vol. ii. pp. 4 and 50 (1888), *ibid.* p. 204, pl. xix. (1894); Heller, *Abh. Mus. Dresden*, 1890-91, No. 2, pp. 3 and 31 (1890); Nehring, *Zool. Anzeiger*, 1890, p. 448; Jentink, *Notes Leyden Mus.* vol. xvi. p. 199 (1894); Meyer, *Abh. Mus. Dresden*, 1896-97, No. 6, p. 12, pls. vii. and viii. (1896); Thomas, *Trans. Zool. Soc.* vol. xiv. p. 410 (1898).

Anoa mindorensis, Steere, *Proc. Zool. Soc.* 1888, p. 413; Oustalet, *Bull. Mus. Paris*, 1895, p. 202.

Probubalus mindorensis, Steere, *loc. cit.* (1888).

Bos mindorensis, Lydekker, *Royal Nat. Hist.* vol. ii. p. 206 (1894), *Geogr. Hist. Mamm.* p. 47 (1896).

Plate X. Fig. 1.

Characters.—A small, rather stoutly built species, in many respects intermediate between small forms of the Indian buffalo (such as the one from Borneo mentioned on p. 126) and the anoa; the height at the shoulder being somewhere about 3 feet 6 inches.¹ Horns short but stout, marked with very deep irregular transverse grooves and pits for the greater part of their length; their direction mainly upwards, with the tips some-

¹ The measurement taken from the British Museum example, which is said to have been made too low and too thick in the mounting.



TAMARAU (1) AND ANOA (2)

what incurved ; those of cows slenderer and more widely separated at their bases ; colour black. Hair less sparse than in the larger buffaloes, reversed on the middle line of the back from the occiput to the haunches ; its general colour ashy-black, but in some cases apparently dark brown ; a triangular patch on the inner side of each eye, one or two spots on each side of the lower jaw, the lower lip, in some cases a gorget (or a pair of such) on the throat, the inner surface of the ears, a patch or band above each hoof, and in some examples a larger irregular patch above this on the front and inner side of either the front or both legs, whitish or grayish-white. Head relatively shorter than in the Indian buffalo ; the ears rather small, with a band on the inner margin fringed with long brownish-white hairs.

In the exhibited example of this buffalo in the British Museum the white gorget on the throat is wanting, although present in the specimens described and figured by Dr. Meyer. The gorget, when present, is similar to the one on the throat of the small Bornean race of the Indian buffalo, to which this species presents a considerable resemblance, although its horns are shorter and more upright. In the direction of the horns, as well as in the presence of one or two pairs of spots on the lower jaw, the tamarau is, however, more like the anoa. By Dr. Jentink it has, indeed, been suggested that the tamarau is a hybrid between the anoa and the Indian buffalo. But, apart from other considerations, this would imply the existence of the anoa in the Philippines, of which there is no evidence either at the present time or in the past. And it may accordingly be admitted that the tamarau is a perfectly distinct form ; although whether it should best be regarded as an aberrant race of the Indian buffalo or as a species by itself may perhaps admit of argument.

Distribution.—The island of Mindoro, situated on the western side of the Philippine group, between Palawan and Calamianes on the south and Luzon on the north.

In this place it may be well to mention that two other buffaloes have been described from the Philippines. The first of these is the *Bubalus mainitensis*, of Heude,¹ from the island of Mindanao, at the south-eastern corner of the group ; but since its describer himself states that “*ce buffle est actuellement entièrement domestique*,” its claim to rank as a species cannot, for the present at least, be admitted.

The second, which is reputed to come from the island of Busuanga, in the Calamianes sub-group, has been named by Dr. Nehring *B. moellendorffi*.² But a gentleman who has resided for a long period in the Calamianes informed Dr. Meyer³ that there are no wild buffalo on any of the islands of that group.

Habits.—The tamarau seems to be distributed all over Mindoro, although chiefly found in the neighbourhood of marshes and near the mouths of the rivers. Professor Steere, by whom the British Museum specimen was procured, gives the following account:⁴—“The animals are buffalo-like in habits ; they come out upon the sandy reaches of the rivers at night to fight and to escape the insects, and gather together in bands of some size. They separate by day, going two or three together, or solitarily, into the low bottoms at the back of the streams, feeding on the wild sugar-cane, and making their way to the little forest streams and pools, in which they bathe in the water and the mud like the buffaloes. The domestic buffalo, the only beast of burden here, has escaped from its owners in the island of Mindoro in large numbers, and is now found wild, and is called cimmarone. The tamarau and these come into frequent conflict ; the tamarau being said to attack the buffaloes at first sight, and, though much smaller, being quicker and stronger, to drive the buffaloes back.”

Mr. J. Whitehead, in a letter to Mr. O. Thomas, furnishes the following

¹ *Mem. Hist. Nat. Emp. Chinois*, vol. ii. p. 205 (1894), iii. p. 45, pl. x. (1896).

² *SB. Ges. naturf. Berlin*, 1894, p. 185.

³ *Op. cit.* p. 13.

⁴ Owing either to a misprint or an error, the animal is termed the “tamaron” in the original.

additional particulars:—"This interesting little bovine is not uncommon in the huge virgin forests that cover nearly the entire island of Mindoro. It is, however, difficult to hunt the animal successfully unless a number of beaters, accompanied by good dogs, are employed. I foolishly employed a professional native hunter for several days; but, although we found a number of fresh tracks, we never saw a sign of a tamarau. The tamarau, as the natives name this animal, is also found high up on the mountains. I have seen regular tunnelled pathways through the thick bamboo undergrowth which covers the mountain-sides above 6000 feet. But the animal is so small that one has to bend double or go on one's hands and knees, making it quite impossible to follow up the tracks. On moonlight nights the tamarau might be heard bellowing on the mountain-side, generally far away and above my camp. The aboriginals of Mindoro told me that they never attack the tamarau, being too much afraid of it; the only reduction of its numbers is caused by a few sporting Spaniards and one or two professional Indian hunters."

6. THE ANOA, OR CELEBES BUFFALO—*BOS DEPRESSICORNIS*

Antilope (Anoa) depressicornis, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 293, v. p. 355 (1827).

Bos (Anoa) depressicornis, Gray, *Spicil. Zool.* p. 12 (1828).

Antilope depressicornis, Quoy and Gaimard, *Ann. Sci. Nat.* vol. xvii. p. 623 (1829), *Voyage de l'Astrolabe—Zool.* vol. i. p. 136 (1830).

Anoa depressicornis, Swainson, *Classif. Quadrupeds*, p. 286 (1835); Gray, *List. Mamm. Brit. Mus.* p. 153 (1843), *Cat. Ungulata Brit. Mus.* p. 29 (1852), *Cat. Ruminants Brit. Mus.* p. 13 (1872); Sundevall, *K. Svenska Vet. Ak. Handl.* for 1844, p. 148 (1846); Heller, *Der Urbüffel, etc.*, p. 5 (1889); Ward, *Records of Big Game*, p. 281 (1896).

Antilope (Taurotragus) depressicornis, Wagner, in Schreber's *Säugethiere*, vol. iv. p. 539 (1844).

Bubalus depressicornis, Turner, *Proc. Zool. Soc.* 1850, p. 178; Flower and Garson, *Cat. Osteol. Mus. Coll. Surg.* pt. ii. p. 228 (1884).

Probubalus celebensis, Rütimeyer, *Verhandl. Ges. Basel*, ser. 2, vol. iv. p. 334 (1865), *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 52 (1867).

Bubalus (Anoa) depressicornis, Rütimeyer, *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 26 (1867); Hoffmann, *Abh. Mus. Dresden*, 1887, No. 3, p. 26.

Probubalus (Anoa) celebensis, Rütimeyer, *Abh. schweiz. pal. Ges.* vol. v. p. 189 (1878).

Bos depressicornis, Brehm, *Tierleben—Säugethiere*, vol. iii. p. 448 (1891); Flower and Lydekker, *Study of Mammals*, p. 361 (1891); W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 130 (1891).

Plate X. Fig. 2.

Characters.—Size very small, the height at the shoulder being about 3 feet 3 inches; limbs rather short, body plump, neck thick, and withers rather higher than the hind-quarters. Horns of male of moderate length, arising far below the plane of the occiput, ringed and triangular at the base, nearly straight, and directed upwards and outwards nearly in the plane of the forehead, with the tips sharply pointed. Ears small, well haired at the bases, but becoming almost naked at the tips, and with a tuft of long white hair on the inner side. Tail reaching about to the hocks. In young animals the skin of the body covered thickly with somewhat woolly hair, which becomes gradually more and more sparse with advancing age, until in old individuals it is almost completely bare; hair of middle line of back reversed from the occiput to the haunches, as in the Indian buffalo and tamarau. In young animals the general colour of the hair yellowish-brown; in adults the colour varying from dark brown to blackish, often with white spots in front of the lateral hoofs, on the throat, the hinder part

of the neck, the back, in front of the eyes, and on the sides of the lower jaw, while the inner sides of the cannon-bones may also be white, as are the inner surfaces of the ears ; under-parts generally light brown. Old bulls from which the hair has almost disappeared have the skin as black as in the Indian buffalo. In the lower jaw there are frequently only two lower premolar teeth, although there may be three of these teeth, as in almost all other *Bovidæ*. Although the occipital surface has not the prominent



FIG. 26.—Head of Bull Anoa, from a living specimen. (Rowland Ward, *Records of Big Game*.)

crest found in adults of the larger buffaloes, when compared with that of a young Indian buffalo the skull is almost identical, the resemblance being carried even to the continuation of the vomer as far back as the hinder margin of the palate. As in the tamarau and other buffaloes, the number of pairs of ribs is usually thirteen, although one instance of the presence of fourteen pairs has been recorded by Dr. Heller.

The difference between an anoa skull and that of an adult Indian buffalo is probably in part due to the inferiority in the size of the present species, since it is an established fact that the smaller representatives of a group tend to retain the generalised features of the ancestral type which

become lost in the adults of the larger kinds. It has been urged that the anoa exhibits many traits of affinity with the antelopes; among these being the comparatively straight form of the horns and the frequent presence of the white spots on the sides of the head and sometimes on other parts of the body. The animal is, however, evidently very closely allied to the tamarau, and has probably become dwarfed by its island habitat and the length of time during which it has been separated from its kindred. So that although the anoa is probably to a certain extent a primitive type, some of its generalised features may be due to degeneration. With regard to the two spots frequently developed on the sides of the lower jaw, the antelopes in which similar spots occur are the kudu (*Strepsiceros*) and horned antelopes (*Tragelaphus*); but since these antelopes have cheek-teeth quite different in structure from those of the anoa, it seems very doubtful if the spots in the latter can be regarded as indicative of affinity with antelopes. As mentioned above, the tamarau frequently exhibits similar spots in front of the eyes. In the very general loss of the first lower premolar tooth the anoa is decidedly more specialised than other buffaloes. In the short and sparse hair of the adult, the broad and naked moist muzzle, and the barrel-like form of the body, as well as by its peculiarly bovine odour, its partiality for water and shade, and likewise in its habit of drinking by long draughts instead of in short gulps, the anoa is essentially a buffalo.

It was considered by the late Professor Rütimeyer that the anoa is the species which comes nearest to the under-mentioned extinct Siwalik bovines, but Dr. Heller has pointed out that it is really the tamarau which makes the nearest approach in this respect, and he is of the same opinion as myself in considering that many of the peculiarities of the Celebes animal are due to degeneration.

The following dimensions of anoa horns are given in Mr. Rowland Ward's *Records of Big Game* :—

Length along Outer Curve.	Basal Circumference.	Tip to Tip.
$15\frac{3}{8}$	$7\frac{1}{8}$	$7\frac{1}{2}$
$12\frac{3}{8}$	6	$6\frac{1}{2}$
$12\frac{1}{4}$	$6\frac{1}{4}$	$8\frac{3}{4}$
$11\frac{1}{2}$	$5\frac{3}{4}$	$7\frac{1}{4}$
10	$5\frac{7}{8}$	$5\frac{5}{8}$
$9\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$
$8\frac{7}{8}$	$4\frac{3}{8}$	$4\frac{3}{4}$

Of these the first and largest example is in the Paris Museum, while the three following specimens are in the British Museum.

Distribution.—The island of Celebes. The sapi-utan (wood-ox), as the anoa, in common with other members of the ox-tribe, is called by the Malays, is the most eastern representative of the *Bovidæ*; and, as has been pointed out in the *Deer of all Lands*, its presence in Celebes affords one of the strongest arguments, for regarding that remarkable island as forming a part of the Oriental region, instead of pertaining to the Australasian region.

Habits.—By reason of its shy and retiring habits, very little is known in regard to the anoa in a wild state. It has, however, been ascertained that it inhabits elevated woodland districts, where it goes about in pairs; being in the latter respect quite unlike the larger buffaloes. It always frequents localities far from the haunts of men, and is partial to the neighbourhood of water. From captive individuals it has been ascertained that the period of gestation is thirty weeks. The flesh, especially that of calves, is tender and well flavoured, and therefore much sought after. Its favourite pace is a kind of trot, but it occasionally leaps in a clumsy sort of manner. In captivity the bulls frequently display a pugnacious and spiteful disposition; and it was found necessary to put knobs on the horns of a bull kept at Woburn Abbey.

The first specimen exhibited in captivity of which there is any record was in the Viceregal Menagerie at Barrackpore, near Calcutta, where it was described in 1816 by General Hardwicke.

Two males were subsequently brought to Paris by MM. Quoy and Gaimard, one of which was exchanged in 1845 with the Earl of Derby for an eland. It lived but a short period at Knowsley. In 1863 the Zoological Gardens at Rotterdam received a male anoa; and from that date there has been a continuous succession of these rare and interesting little bovines at that establishment. Between 1863 and 1889 the Rotterdam Gardens have possessed no less than eighteen examples, of which ten were bulls and eight cows, three having been born in the Gardens. From Rotterdam the London Zoological Gardens purchased a young male in 1871, and they acquired by exchange a female in 1880. Specimens have been exhibited in other public menageries, and at the present time there is a pair living at Woburn Abbey.

7. THE SIWALIK TAMARAU—*Bos TRIQUETRICORNIS* (*Extinct*)

Probubalus sivalensis, Rütimeyer, *Verh. Ges. Basel*, ser. 2, vol. iv. p. 334 (1865), no description, *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 5 (1867).

Bubalus (Hemibos) triquetricornis, Rütimeyer, *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 23 (1867).

(?) *Bos occipitalis*, Falconer, *Pal. Mem.* vol. i. p. 280 (1868); Lydekker, *Horns and Hoofs*, p. 48 (1893).

Hemibos triquetriceros, Falconer and Cautley, in Falconer's *Pal. Mem.* vol. i. p. 546 (1868); Lydekker, *Pal. Ind. (Mem. Geol. Surv. Ind.)*, ser. 10, vol. i. p. 145 (1878).

(?) *Peribos occipitalis*, Lydekker, *Pal. Ind. (Mem. Geol. Surv. Ind.)*, ser. 10, vol. i. p. 141 (1878).

Probubalus (Hemibos) triquetricornis, Rütimeyer, *Abh. schweiz. pal. Ges.* vol. v. p. 122 (1878).

Probubalus triquetricornis, Rütimeyer, *op. cit.* p. 189 (1878).

(?) *Hemibos occipitalis*, Lydekker, *Pal. Ind. (Mem. Geol. Surv. Ind.)*, ser. 10, vol. i. p. 174 (1880).

(?) *Bubalus occipitalis*, Lydekker, *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 30 (1885).

Characters.—Nearly allied to the next species, but the horn-cores rising from a more prominent frontal ridge, sloping more away from the plane of the forehead, and their proper front surface directed more towards the frontal aspect, being thus more like the tamarau. In the typical form the horn-cores are markedly triangular, but in the specimens described under the name of *occipitalis* the front outer angle is rounded off, so as to give a pyriform section, and the tips are curved forwards. By the late Professor Rüttimeyer these two variations were not considered worthy of specific separation, the second being distinguished as the *trochoceros* form.

Distribution.—Northern India during the Pliocene period.

8. FALCONER'S TAMARAU—*BOS ACUTICORNIS* (*Extinct*)

Amphibos acuticornis, Rüttimeyer, *Verh. Ges. Basel*, ser. 2, vol. iv. p. 331 (1865), no description, *Abh. schweiz. pal. Ges.* vol. v. p. 147 (1878); Falconer and Cautley in Falconer's *Pal. Mem.* vol. i. p. 547 (1868).

Probubalus acuticornis, Rüttimeyer, *Verh. Ges. Basel*, ser. 2, vol. iv. p. 334 (1865), no description, *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 52 (1867).

Bubalus (Amphibos) acuticornis, Rüttimeyer, *Denkschr. schweiz. Ges.* vol. xxii. part 2, art. 3, p. 29 (1867).

Hemibos acuticornis, Lydekker, *Pal. Ind. (Mem. Geol. Surv. Ind.)*, ser. 10, vol. i. p. 176 (1880).

Bubalus acuticornis, Lydekker, *Cat. Foss. Mamm. Brit. Mus.* part ii. p. 33 (1885).

Bos acuticornis, Lydekker, *Horns and Hoofs*, p. 48 (1893).

Characters.—Size apparently much the same as in the tamarau, but the horns longer. Skull generally like that of the tamarau, but the horn-cores more distinctly triangular in section, with their front outer angle brought

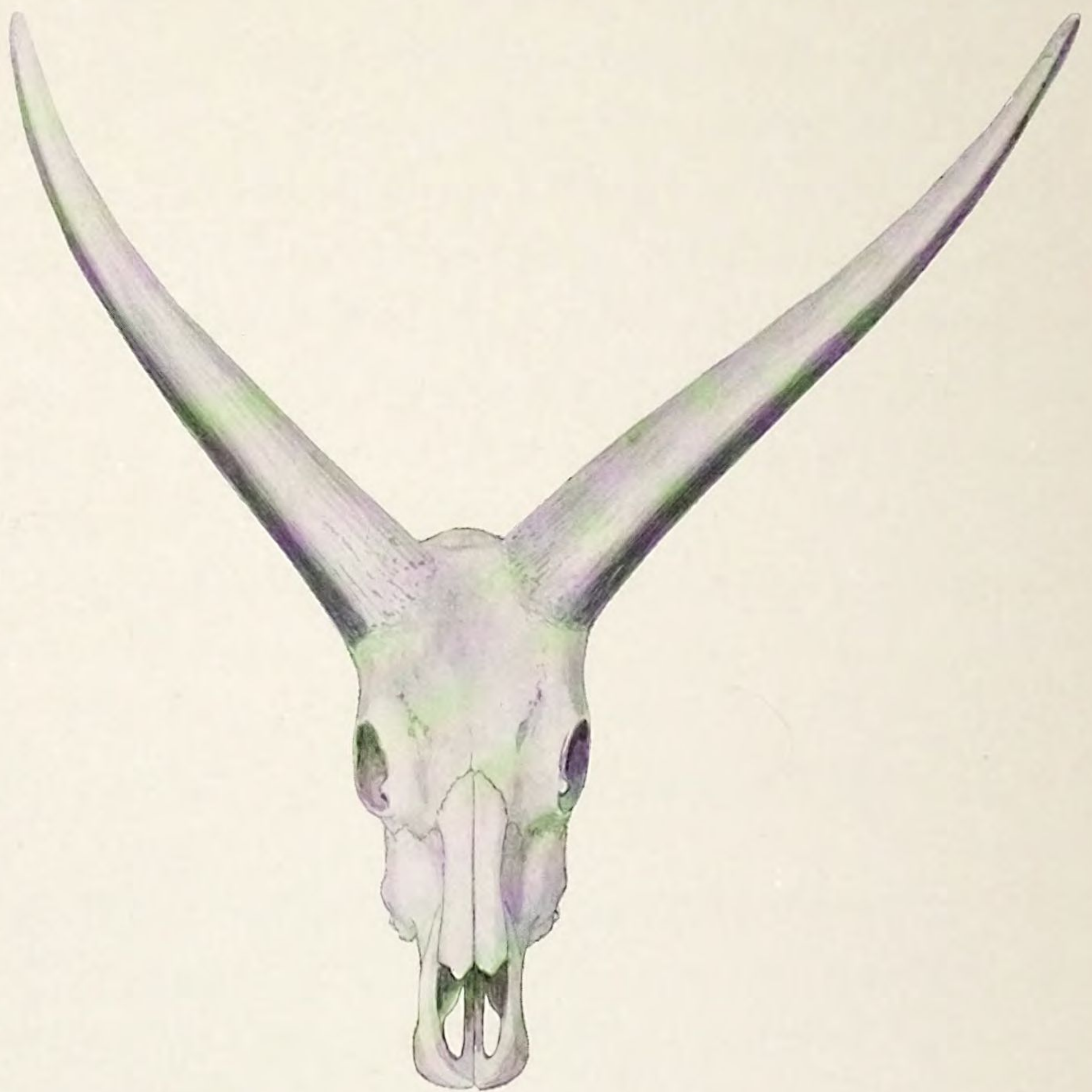


FIG. 27.—Skull and horn-cores of Falconer's Tamarau. Restored from a specimen in the British Museum.

much more on to the frontal aspect of the skull, and the proper frontal surface of the horn-cores consequently directed to a great extent upwards, instead of almost immediately forwards. Horn-cores long, pointed, and directed upwards and outwards, with the front outer angle forming a sub-spiral curve arising at its base near the middle line of the horn-cores, as seen from the front.

The following are the dimensions of the figured specimen :—

Width of skull beneath horn-cores	$4\frac{1}{2}$ inches
Length of horn-cores along greater curve	27 „
Interval between tips	$33\frac{1}{2}$ „
Diameter of inner surface of base of horn-core	$3\frac{1}{2}$ „
Basal girth of horn-core	12 „
Interval between bases of horn-cores	$2\frac{3}{4}$ „

Distribution.—Northern India during the Pliocene epoch.

INCERTÆ SEDIS

Anoa santeng, Dubois, *Nat. Tijds. Nederl. Ind.* vol. li. pt. 1, p. 96 (1891); Jentink, *Notes Leyden Mus.* vol. xiii. p. 220 (1891).

Named on the evidence of an unfigured and insufficiently described skull obtained from the superficial deposits of Java, and said by its describer to indicate an animal allied to the anoa of Celebes, which may still be living in the island. The evidence is considered insufficient by Dr. Jentink.

II. THE MUSK-OXEN—GENUS OVIBOS

Ovibos, De Blainville, *Bull. Soc. Philom. Paris*, 1816, p. 76; Gray, *Cat. Ungulata Brit. Mus.* p. 42 (1852); Rütimeyer, *Abhand. schweiz. pal. Ges.* vol. v. p. 103 (1878); P. Thomas, *Bull. Soc. Zool. France*, 1881, p. 25; Rhoads, *Proc. Acad. Philadelphia*, 1895, p. 242; Matschie, *SB. Ges. naturf. Berlin*, 1898, p. 30.

Boötherium, Leidy, *Proc. Acad. Philadelphia*, vol. vi. p. 71 (1851).

Characters.—Size medium; build stout and clumsy; the neck short, and the head carried only slightly above the level of the back; no dewlap. Extremity of muzzle moderately broad, and, except for a narrow strip on the inner margins of the nostrils, and a triangular patch where these two

lines converge inferiorly, covered with short fine hair ; no glands on the face ; probably two teats in the female ;¹ ears short and thickly haired ; tail very short and rudimentary, entirely concealed amid the long hair of the hind-quarters ; main hoofs large, flattened, broad, and slightly unsymmetrical, the outer one being more rounded and the inner one more pointed ; lateral hoofs also large ; under surface of feet partially covered with hair between the hoofs. Horns present in both sexes, much larger in the male than in the female ; those of the former more or less approximated at the bases, arising close to the occiput, and when adult extending nearly to the sockets of the eyes, expanded and flattened at the bases, where they are marked by coarse longitudinal groovings, at the tips smoother, their curvature outwards, or outwards and then downwards at first ; those of female always widely separated at the bases, situated midway between the occiput and the upper border of the sockets of the eyes, so as to leave a broad parietal zone above them, nearly cylindrical throughout the greater part of their length. Pelage long and shaggy ; and general coloration nearly uniform. Upper molar teeth with tall but comparatively narrow crowns, on the inner side of which there is no distinct additional column. Skull without either pits or fissures below the eyes ; the sockets of the eyes greatly produced and tube-like ; the premaxillæ separated from the nasal bones, which are short and wide ; and a distinct, broad parietal zone on the anterior aspect above the frontal bones. Cannon-bones short and stout, as in the oxen.

In young musk-oxen the horns are in the form of simple spikes growing straight out from the sides of the head, and widely separated at their bases on the forehead, which is thickly haired.

The true relationships of the musk-oxen are still far from clearly ascertained. At one time they were regarded as intermediate between the oxen and the sheep, while at a later period they were considered to be

¹ I have been unable to ascertain the number.

more nearly related to the latter, which they approach in the structure of their molar teeth and hairy muzzles. The rudimentary condition of the tail, which is shorter than in any of the sheep, widely separates them from the oxen ; but, on the other hand, their short and wide cannon-bones are similar to those of the latter animals and quite different to the corresponding bones of the sheep and goats. From the study of fossil forms Mr. Rhoads has been led to suggest the existence of a transition between the musk-oxen and the bison, but the structure of the molar teeth and the rudimentary tail seem to negative any near relationship between the two groups. Some years ago Prof. A. Milne-Edwards suggested an affinity between the present genus and the Tibetan takin (*Budorcas*), and the two genera were subsequently placed in juxtaposition by the late Prof. Rütimeyer. The idea of this latter relationship has recently been developed by Dr. Matschie, who regards the two genera as forming a sub-family by themselves, the *Ovibovinae*. As indications of their mutual affinity, he notices the short and broad front cannon-bones, the structure of the skull and form of the horns, the small ears, the hairy muzzle, the short tail, the clumsy main hoofs, and the large size of the lateral pair.

As regards the horns, the structure of the sheaths is quite different in the two, and I cannot see that such resemblance as exists in their form and curvature is likely to be anything more than superficial. The skull of *Budorcas* lacks the projecting tubular orbits of the musk-oxen. The form of the cannon-bones equally affiliates the present genus to the oxen ; and the characters of the ears, tail, and hoofs I cannot regard as of much classificatory value.

Mr. Blanford has placed *Budorcas* in the neighbourhood of the serows (*Nemorhædus*), and at present I fail to see any sufficient reason for departing from this arrangement. This leaves *Ovibos* without any near existing relatives, and since palæontology throws no light on the subject, it must

apparently be regarded as a more or less isolated and specialised type, with some affinity to the sheep.

Distribution.—The central and northern parts of the Holarctic region, to the northern portion of the western half of which it is restricted at the present day.

1. THE GREENLAND MUSK-OX—OVIBOS MOSCHATUS

Bos moschatus, Zimmermann, *Geograph. Geschichte*, vol. ii. p. 86 (1780); Huet, *Bull. Soc. Acclim. Paris*, vol. xxxviii. p. 346 (1891).

Ovibos moschatus, De Blainville, *Bull. Soc. Philom. Paris*, 1816, p. 76;

Desmarest, *Mammalogie*, vol. ii. p. 492 (1822); H. Smith, in Griffith's *Animal*

Kingdom, vol. iv. p. 373 (1827);

Richardson, *Fauna Bor. Amer.* p. 275

(1829); Ogilby, *Proc. Zool. Soc.* 1836,

p. 137; Gray, *List Mamm. Brit. Mus.*

p. 153 (1843), *Cat. Ungulata Brit.*

Mus. p. 43 (1852), *Cat. Ruminants*

Brit. Mus. p. 32 (1872); Dawkins,

Brit. Pleist. Mamm. pt. v. (*Pal. Soc.*

1872), *Quart. Journ. Geol. Soc.* vol.

xxxix. p. 575 (1883); Lydekker, *Cat.*

Foss. Mamm. Brit. Mus. pt. ii. p. 38

(1885); Newton, *Vertebrata of Pliocene*

Deposits of Britain (*Mem. Geol. Surv. United Kingdom*), p. 22 (1891);

Feilden, *Zoologist*, ser. 3, vol. xix. p. 41 (1893); Ward, *Records of Big*

Game, p. 260 (1896).

Ovibos pallantis, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 375 (1827).



FIG. 28.—Head of male Greenland Musk-Ox.
(Rowland Ward, *Records of Big Game*.)



MUSK—OX.

Bos pallasii, De Kay, *Ann. Lyc. New York*, vol. ii. p. 29 (1828), *nec* Baer, 1823.

Bos canaliculatus, Fischer, *Mém. Acad. Moscou*, vol. iii. p. 287 (1834).

Bubalus moschatus, Owen, *Quart. Journ. Geol. Soc.* vol. xii. p. 124 (1856).

Plate XI.

Characters.—Height of male at shoulder from about 4 feet to 4 feet 2 inches. Head short and blunt, with a slightly convex profile. Horns of male enormously expanded and flattened at the base, separated from one another merely by a narrow strip of skin covered with short hair; curvature at first outwards, then downwards and slightly backwards, and finally upwards and a little forwards, their tips terminating in the plane of the eyes; in colour pale yellowish-olive at the bases, but black at the tips, which are quite smooth and cylindrical. Horns of female with the same general curvature. The greater part of the head and body covered with a dense coat of long and coarse hair, which is curly and somewhat matted at the shoulders, but elsewhere long and straight, hanging down on the flanks to below the level of the knees and hocks; on the neck and withers it forms a kind of matted mane, the forehead has a distinct tuft, and there is a long fringe on the chin, throat, and chest, although no dew-lap is developed; on the muzzle and lower portion of the limbs, as well as on the strip of skin between the horns, shorter and finer than elsewhere; a soft woolly under-fur at the bases of the longer hairs which is shed in summer. General colour of pelage very dark brown, becoming still darker or even blackish on the forehead, the throat-fringe, and the sides of the body; a saddle-shaped patch of matted hair on the middle of the back, as well as the short hair between the horns, on the muzzle, and on the limbs below the knees and hocks, buffish or yellowish-white.

There is no evidence that the musky odour to which the animal owes

its name is the secretion of any special scent-gland, but further details of its anatomy are required before this can be regarded as definitely ascertained.

The following dimensions of horns are recorded by Mr. Rowland Ward :—

Length along Outer Curve.	Width of Basal Expansion.	Tip to Tip.	Locality.
$29\frac{3}{4}$	13	?	?
$27\frac{1}{4}$	$12\frac{1}{2}$	27	N. America
$26\frac{7}{8}$	11	27	N. Canada
$26\frac{3}{4}$	$12\frac{3}{8}$	?	N. America
$26\frac{1}{4}$	$13\frac{1}{8}$	$27\frac{5}{8}$	„
$24\frac{3}{4}$	11	$25\frac{1}{2}$	N. Canada
$24\frac{1}{4}$	$10\frac{1}{2}$	26	„
24	?	30	N. America
24	$9\frac{3}{4}$	$23\frac{1}{8}$	„
$22\frac{3}{4}$	$9\frac{1}{4}$	$19\frac{1}{4}$	Grinnell-land.
$21\frac{1}{2}$	9	27	?

Good horns of females measure between 18 and 19 inches along the outer curvature, with a basal expansion of about 4 inches.

Distribution.—At the present day Arctic America, eastwards of the Mackenzie river and northwards of the 60th parallel through Parry Islands and Grinnell-land (lat. $82^{\circ} 27'$) to the north of Greenland, on the western coast of which it extends as far south as Melville Bay, and on the eastern coast to Sabine Island. Unknown in Spitzbergen or Franz Joseph Land, as it is in Alaska, although it formerly extended at least as far as Eschscholtz Bay. During the Plistocene period a large part of Europe and Northern Asia, ranging as far as the Alps and Pyrenees.

Colonel Feilden states that at the present day the distributional area of the musk-ox includes about two-thirds of the coast-line of Greenland. He concludes that the advent of the animal in that country has been from the westward, and that the progenitors of the herds now living on the east coast rounded the north of Greenland and spread southwards until they

encountered some physical obstacle, such as the glaciers of Cape Farewell, capable of barring their further progress. Probably the same has been the case also on the western coast, where the great glaciers debouching into Melville Bay would appear to have set a limit to the wanderings of the animal in this direction. "The distribution of the musk-ox along the shores of Greenland," continues the same writer, "covers an immense coast-line; we have traced it from Polaris Bay, on the north-west side of Greenland, from about 81° north to Independence Bay on the north-east coast in about the same latitude, and from there as far south as the seventieth parallel. On the east coast of Greenland the range of the musk-ox in a line drawn over the map from north to south embraces at least 700 geographical miles."

The British Museum possesses skulls of the existing musk-ox from the frozen superficial deposits of Eschscholtz Bay, Alaska, found in company with those of the Plistocene bison and the mammoth.

The Russian naturalist Pallas discovered two skulls of the musk-ox in the superficial deposits of Northern Asia, one on the banks of the Obi, and the other farther north in the Siberian tundra. It was these specimens that were mentioned by Holl as *Bos moschatus*, and much later on by De Kay as *Bos pallasi*. Subsequently other remains were discovered by the late Prof. Lartet in Perigord, in association with remains of man, the reindeer, and the bison. They have also been found in various parts of Central Europe, notably near Ulm, in Würtemberg, in association with bones of the reindeer, the mammoth, and the woolly rhinoceros. Similar remains have been disinterred from the Plistocene gravels of several districts of England, such as those of Maidenhead, Bromley, Freshfield near Bath, and Barnwood near Gloucester, as well as from the brick-earths of the Thames Valley at Crayford in Kent. In 1883 Mr. W. B. Dawkins described the imperfect skull of a musk-ox found at Trimingham which there seems every probability was derived from the Norfolk forest-bed, forming the

base of the Plistocene deposits, and antedating the glacial epoch. A second specimen, described by the same author and preserved in the Woodwardian Museum at Cambridge, is believed to have had a similar origin, although dredged from the bed of the North Sea.

Habits.—The musk-ox has, I believe, never been brought alive to Europe, and indeed would probably be unable to withstand transportation from its icy home to more genial climates; naturalists are therefore compelled to rely exclusively on the accounts of its habits given by explorers and sportsmen, like Colonel Feilden and Mr. Warburton Pike, who have seen the animal in its native haunts. Musk-oxen associate in herds numbering from about twenty or thirty to as many as eighty or a hundred head. The herds appear to be largest in winter, the big bulls during the summer being for the most part solitary, and the herds consisting of cows and calves which go about in small bands of from ten to twenty. The movements of the herds are described by Colonel Feilden as very sheep-like, the old bulls, when present, taking the lead, and the whole assemblage crowding together when alarmed, much after the manner of a flock of sheep. The single calf is produced in May or June, and the cows are reported by the natives to breed only once in two years, so that the rate of increase is slow. In summer their food, according to Mr. Pike, consists almost exclusively of the leaves of the small willows scattered here and there over the Barren Grounds; but grass, moss, and lichens are also largely consumed, and in winter these two last, with perhaps bark, must form the sole nutriment. To obtain lichens and moss the snow is scraped away to a great extent by the hoofs, which from their shape are admirably adapted for this purpose, as they are for climbing rocky ridges. The horns are, however, also said to be brought into use for clearing away snow. By the end of the short northern summer musk-oxen have generally fed themselves up into prime condition, but in April, when they are first hunted by the natives of the Barren Grounds, they are miserably thin. Although it has

been reported that in winter the musk-oxen on the mainland come south to the wooded districts, this, according to Mr. Pike, is an error.

In spite of their comparatively short and massive limbs, musk-oxen can run with considerable speed ; and when thoroughly alarmed they are stated to take to hilly ground, where they display marvellous agility in climbing precipitous cliffs. Where they have not been much molested, and especially when far away from water, the herds may be approached without difficulty, and the sport of shooting is consequently comparatively tame. In spite of stories to the opposite effect told by the Indians, Mr. Pike is of opinion that even old bulls are by no means dangerous animals ; and even when wounded they seldom, if ever, charge. Although the flesh of old bulls is rank and musky in the extreme, that of cows in good condition is stated to be palatable enough ; calves, however, afford but an insipid and unsatisfying food.

The skins of musk-oxen are largely used in Canada for sleigh-rugs, and since the extermination of the bison the demand for, and the price of these "robes," as they are termed, has considerably increased. In 1891 the Hudson Bay Company sold 1358 of these skins at prices varying from six shillings to six pounds apiece. To procure the skins, hunting parties are organised by the Canadian Indians, and large numbers of the animals slain. In winter the herds are rounded up with dogs, and wholesale slaughter takes place. In summer, according to Mr. Pike, no dogs are used, but the animals are driven into the waters of some small lake, upon which canoes are launched and the whole band quickly exterminated, the animal being but a poor swimmer, and apparently finding considerable difficulty in keeping its head above water.

Mr. Caspar Whitney, who is also one of those who have successfully hunted the musk-ox, writes that, in general, Indian dogs, strange as it may seem, are not of much use in the pursuit. "Theirs is a craven nature, and but for the urgency imparted by the pangs of hunger, they would be of

little use in bringing the musk-cattle to bay. . . . The musk-ox usually stops when wounded, and shows little inclination to go on ; and, as a rule, they will stand until the last one has been killed, narrowing their circle as their numbers diminish." When attacked by their great enemy the wolf, they also form a circle, with the calves in the middle, and the lowered heads of the adults facing the enemy.

In spite of the wholesale slaughter, Mr. Pike is of opinion that even on the mainland the musk-ox stands in little, if any danger of impending extermination. Even on the most frequented hunting-grounds it is still met with in vast numbers, and all these tracts are situated only on the extreme verge of the musk-ox country, which extends to the desolate regions bordering the Arctic Ocean, where only a few Eskimo eke out an existence near the coast. This impenetrable country probably serves therefore as a feeder to the hunted districts farther south.

2. HARLAN'S MUSK-OX—OVIBOS BOMBIFRONS (*Extinct*)

Bos bombifrons, Harlan, *Fauna Americana*, p. 271 (1825).

Boötherium bombifrons, Leidy, *Proc. Acad. Philadelphia*, vol. vi. p. 71 (1852).

Boötherium cavifrons, Leidy, *loc. cit.* (1852).

Ovibos priscus, Rüttimeyer, *Verh. Ges. Basel*, ser. 2, vol. iv. p. 328 (1865).

Ovibos bombifrons, Dawkins, *Quart. Journ. Geol. Soc.* vol. xxxix. p. 577 (1883) ; Lydekker, *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 39 (1885).

Ovibos cavifrons, Dawkins, *loc. cit.* (1883) ; Lydekker, *op. cit.* p. 40 (1885) ; M'Gee, *Amer. Journ. Science*, ser. 3, vol. xxxiv. p. 217 (1887).

Characters.—Horn-cores of male directed mainly outwards and somewhat downwards at the tips, without the close approximation to the sides of the skull characteristic of the existing species ; their bases much less expanded than in the latter, and apparently less approximated in the middle

line, possibly also smoother. In the female cylindrical and rugose, with an outward direction, so as to form a regular curve with the convexity in front.

The small skull described as *Boötherium bombifrons* is, I think, rightly identified by Mr. Boyd Dawkins as indicating the female of the animal of which the male is represented by the skull subsequently named *B. cavifrons*. In the latter the centre of the forehead is deeply excavated and the bases of the horn-cores are nearly smooth, but (judging from the cast in the British Museum) it appears that these features are largely due to injury or imperfection, as may also be the relations of the frontal plane to that of the sockets of the eyes.

As regards the curvature of the horns, this species would seem to be less specialised than the last, thereby suggesting an American origin for the genus.

Distribution.—North America during the Plistocene period ; the skull described as *Boötherium bombifrons* was obtained from Kentucky, and the one named *B. cavifrons* from Arkansas.

III. THE SHEEP—GENUS OVIS

Ovis, Linn. *Syst. Nat.* ed. 12, vol. i. p. 97 (1766).

Characters.—Size medium or small ; build of moderate stoutness, with the limbs rather long and slender ; neck of moderate depth and length, and the head carried well above the level of the back ; no dewlap. Muzzle narrow, pointed, and covered with short fine hair, save for a small naked area immediately above and between the nostrils ; glands invariably present between the hoofs of both feet, and frequently also on the face below the eyes ; two teats in the female ; no beard or strong odour in the males ; ears moderate, upright, pointed, and well haired ; tail in all wild species except one short and pointed ; main hoofs

symmetrical, rather small, narrow, and upright; lateral hoofs also small. Both sexes generally provided with horns, which are large and spreading in the males, but, except in one case, small and upright in the females; those of males directed at first outwardly from the sides of the head, with the upper border convex at starting, and then generally forming a circular or spiral curve, with the tips pointing outwards; in section generally more or less distinctly triangular, and the surface, of which the colour is usually some shade of yellowish-olive or brown, in most cases marked by fine parallel transverse wrinkles. Pelage usually consisting of close, short, stiff hair, which may be elongated into a ruff on the chest and throat, and in one instance is long and shaggy on the whole of the throat, chest, and front surface of the fore-limbs; coloration usually some shade of rufous, brown, or tawny, becoming lighter on the under-parts, and in some cases with blackish markings between the dark and light areas and on the limbs. Upper molar teeth with tall, narrow crowns, on the inner side of which there is no additional small column comparable to that of the oxen. When face-glands are developed, the skull has shallow pits below the eyes for their reception, but only very small unossified vacuities. Cannon-bones in both limbs relatively long and slender, and thus quite unlike those of either the oxen or the musk-ox.

As additional characters of the skeleton, it may be mentioned that the skull is broadest across the sockets of the eyes, which are fairly prominent but not distinctly tubular; below these it narrows suddenly, and thence tapers gradually to the muzzle; the planes of the forehead and the occiput (the latter of which includes the parietal bones) meet one another nearly at a right angle, the true occiput being almost flat.

Although very closely connected with the goats, the relationship of the sheep to other members of the family *Bovidae* is still very obscure. They appear to be an essentially modern group, possibly even of later origin than the oxen, as it is doubtful whether they are represented in the

Siwalik deposits of India, where remains of the latter are abundant. That they have no intimate relationship with the oxen, may be considered fairly certain; and it seems more than doubtful if they have any very near kinship with the musk-oxen, from which they differ markedly in the structure of the horns and in the form of the cannon-bones. Antelopes, so far as our present knowledge goes, are among the oldest of the hollow-horned ruminants, and since the gazelles and their allies have molar teeth of the same general structure as those of the sheep, it is possible that the latter may be a specialised offshoot from the ancestral stock of the former.

From the point of view of the systematic naturalist sheep form an excessively difficult group to deal with. In the first place, several of the local forms are so similar to one another that it is almost impossible to decide whether they should be regarded as species or races. And, in the second place, the more aberrant members of the group exhibit so many characters common to the goats that it becomes a question whether, on the one hand, it would not be advisable to include both sheep and goats in a single genus, or whether, on the other, the sheep themselves might not be divided into at least three genera. As a compromise, three distinct subgenera, or groups, of wild sheep are here recognised. In addition to these, the various breeds of domestic sheep (*Ovis aries*), which form the type of the whole genus, are perhaps entitled to constitute a fourth and typical group. Here it may be mentioned that the ancestral form of these domestic breeds, which differ from all the wild species save the arui by the length of the tail, is at present totally unknown, so that no detailed mention of the typical group is made in the present work. The woolly character of the pelage, which forms such a marked feature in the European breeds of sheep, might seem another feature distinguishing all the domesticated kinds from the wild species. This, however, is not the case, since many of the domesticated breeds belonging to less civilised tribes, like

several of those of Africa, have more or less distinctly hairy coats ; and it is stated that this type of pelage tends to reappear in the woolly breeds of domesticated sheep which have run wild.

“Sheep,” writes Darwin in his *Animals and Plants under Domestication*, “have been domesticated from a very ancient period. Rütimeyer found in the Swiss lake-dwellings the remains of a small breed, with thin, tall legs, and horns like those of a goat, thus differing somewhat from any kind now known. Almost every country has its own peculiar breed ; and many countries have several breeds differing greatly from each other. One of the most strongly marked races is an Eastern one with a long tail, including, according to Pallas, twenty vertebræ, and so loaded with fat that it is sometimes placed on a truck, which is dragged about by the living animal. These sheep, though ranked by Fitzinger as a distinct aboriginal form, bear in their drooping ears the stamp of long domestication. This is likewise the case with those sheep which have two great masses of fat on the rump, with the tail in a rudimentary condition. The Angola variety of the long-tailed race has curious masses of fat on the back of the head and beneath the jaws. Mr. [Brian] Hodgson, in an admirable paper on the sheep of the Himalaya, infers from the distribution of the several races that this caudal augmentation in most of its phases is an instance of degeneracy in these pre-eminently Alpine animals. The horns present an endless diversity in character, being not rarely absent, especially in the female sex, or, on the other hand, amounting to four or even eight in number. The horns, when numerous, arise from a crest on the frontal bones, which are elevated in a peculiar manner.”

The important feature in this passage is Hodgson's theory that the length of the tail in the domesticated breeds is due to degeneracy. And if this be true, and bearing in mind that the horns of many of such breeds are of the same general character as those of several members of the Caprovine group, it is quite possible that the latter is really identical with the typical,

or Ovine group. For the present, however, it seems preferable to allow the former to stand as a subdivision of the genus.

Distribution.—The Holarctic and Sonoran regions, with one species just impinging on the north-western frontier of the Oriental region. The headquarters of the genus are the highlands of Central Asia, where there occur two out of the three groups into which its wild members are divided. In America there is but a single species, represented by a local race in Kamschatka; and North Africa has likewise only one species, which is, however, very distinct from all the others. In most respects the distribution of the sheep is very similar to that of the genus *Cervus*, especially in having one peculiar type common to Eastern Asia and North America, but it differs in the marked distinction of the African from the European form. In a fossil state sheep are not definitely known previous to the epoch of the Norfolk forest-bed, forming the earliest stage of the Plistocene epoch, although there is some evidence that they may be represented in the Indian Siwaliks.

Habits.—Sheep, like goats, are essentially mountain-dwellers, associating either in small parties or in large flocks, the latter of which are, however, formed during the greater part of the year by ewes and young rams alone, the old rams keeping apart. In Asia sheep generally inhabit more open and undulating ground than that tenanted by goats, and do not frequent precipitous cliffs. The rams, more especially during the pairing season, are extremely pugnacious animals, fighting by charging one another from a considerable distance, and receiving the impact of the charge on the forehead. In these contests the majority of the species do not raise themselves on their hind-legs when butting, after the manner of goats, although this is the case with the bharal, which is structurally the most goat-like of the group. From the absence of any strong odour in the males, the flesh of all the species of wild sheep is of excellent quality.

i. CAPROVINE GROUP—SUB-GENUS CAPROVIS

Caprovis, Hodgson, *Journ. As. Soc. Bengal*, vol. xvi. p. 702 (1847); Gray, *Cat. Ungulata Brit. Mus.* p. 171 (1852).

Musimon, Gray, *Knowsley Menagerie*, p. 36 (1850), *Cat. Ungulata Brit. Mus.* p. 172, as a sub-genus.

Argali, Gray, *Knowsley Menagerie*, p. 37 (1850), *Cat. Ungulata Brit. Mus.* p. 174 (1852), as a sub-genus.

Characters.—Horns of males forming a circular or spiral curve, strongly angulated (at least when young), and with more or less distinct transverse wrinkling. Face with small and indistinct glands, and depressions in the skull below the eye-sockets for their reception. A clearly defined black line between the fawn of the back and the light of the under-parts, and distinct black markings on the front of the limbs are frequently wanting, although present in some species. No long fringe extending from the throat to the fore-legs. Tail very short.

Distribution.—Coextensive with that of the genus, except in not extending into Africa.

1. THE EUROPEAN MUFLON—OVIS MUSIMON

Ægoceros musimon, Pallas, *Zoogr. Rosso.-Asiat.* vol. i. p. 230 (1811).

Ovis musmon, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 322, v. p. 360 (1827); Jardine, *Naturalist's Library—Mamm.* vol. iv. p. 132 (1836).

Capra musmon, Fischer, *Synop. Mamm.* p. 488 (1829).

Ovis musimon occidentalis, Brandt and Ratzeburg, *Med. Zool.* vol. i. p. 55 (1829).

Ovis musimon, Wagner, in Schreber's *Säugethiere*, vol. iv. p. 242 (1844); Gray, *Knowsley Menagerie*, p. 36 (1850); Blasius, *Säugethiere Deutschlands*, p. 471 (1857).



EUROPEAN MUFLON.

Caprovis musimon, Hodgson, *Journ. As. Soc. Bengal*, vol. xvi. p. 702 (1847) ; Gray, *Cat. Ungulata Brit. Mus.* p. 173 (1852), *Cat. Ruminants Brit. Mus.* p. 56 (1872).

Musimon musmon, Gervais, *Hist. Nat. Mamm.* vol. ii. p. 191 (1855) ; Graells, *Mem. Ac. Madrid*, vol. xvii. p. 369 (1897).

Plate XII.

Characters.—Size small, the height at the shoulder being about 27 inches ; females usually hornless. Horns of male fairly large, stout, and



FIG. 29.—Head of male European Muflon. From a specimen in the British Museum.
(Rowland Ward, *Records of Big Game*.)

strongly wrinkled ; the front surface markedly distinct from the outer one, the front outer angle rounded off, but the inner one distinct ; the curvature of the horns forming a close spiral of about one complete circle, with the tips bending forwards and outwards so as to be situated almost immediately below the eyes. Hair close and thick, elongated in winter on the throat of the rams to form a distinct fringe, and with a thick coat of woolly

under-fur at the same season. General colour of adult rams in late summer or early autumn bright rufous-brown, or foxy-red, becoming chocolate-brown on the head and face; sides of neck, throat, chest, a line on the flanks, a streak down the withers, a saddle-shaped patch on the back, the front and sides of the fore-legs above the knees, and the front and inner side of the hind-legs above the hocks black. Ears grayish externally, white on the margins and part of the interior; muzzle and chin grayish-white, passing into a grayish-rufous patch in the centre of the black area



FIG. 30.—Female Mouflon with horns. From a photograph by the Duchess of Bedford.

on the throat; hinder border of black saddle marked by a broad band grizzled with white. All the under-parts, except a narrow dark streak between the fore-legs, and the buttocks, pure white, which stands out in brilliant contrast to the black band on the flanks. A narrow white streak on the hinder surface of both pairs of legs above the knees and hocks; lower portion of fore-legs white, with a variable amount of black on the front surface between the knees and the pasterns; hind-legs below the hocks similarly coloured, but with less of pure white. In winter the colour darkens and tends more to chestnut-brown, while the saddle-like patch becomes larger and squarer, and assumes posteriorly a yellowish or whitish tint, which is apparently most marked in the very old rams. The face-glands below the eyes are comparatively small. The description of the autumn coloration is taken from a very fine mounted ram in the British Museum shot by Mr. F. G. Barclay in the mountains of the interior of Sardinia.

The ewes seldom have horns, and when present these are usually about 2 inches in length, as shown in the illustration.

The following horn-measurements of this species are recorded by Mr. Rowland Ward :—

Length along Front Curve.	Basal Circumference.	Tip to Tip.	Locality.
$34\frac{1}{2}$	$8\frac{3}{4}$	$16\frac{3}{8}$	Sardinia
$29\frac{5}{8}$	$8\frac{3}{4}$	11	"
29	$8\frac{3}{4}$	11	"
$28\frac{7}{8}$	$8\frac{1}{8}$	21	"
$28\frac{3}{4}$	9	10	"
27	$8\frac{1}{2}$	10	"
27	$9\frac{1}{2}$	$10\frac{1}{2}$	"
26	$10\frac{3}{8}$	$10\frac{1}{2}$	Corsica
$25\frac{1}{2}$	$8\frac{1}{4}$	10	Sardinia
$24\frac{1}{2}$	$9\frac{1}{8}$	$9\frac{7}{8}$	"

Distribution.—At the present day the mountains of Corsica and Sardinia. Said formerly to have inhabited Greece and the Balearic Islands, though this requires confirmation. With regard to the reputed former occurrence of the muflon in Spain, Brehm believes this is due to it having been confounded with the Spanish tur; much the same view being taken by Señor Graells, in his monograph of the mammals of Spain quoted above.

Habits.—Muflon are restricted to certain mountain ranges in their native islands, and there frequent only the higher portions, generally selecting peaks which enable them to take a wide survey of the surrounding country. They are remarkably wary, employing their senses of sight, hearing, and smell; and, according to Mr. Buxton, are in the habit of seeking for spots where currents of air meet. When thus situated they are quite unapproachable, even when their station is otherwise most favourable to the stalker. The ground they generally frequent is broken rather than mountainous; many of the valleys being filled with forests of ilex. When, however, pigs are brought up to feed upon the acorns of the latter, the muflon betake themselves to less disturbed situations. Formerly, at any rate, muflon were found in flocks of very large size,

which at the pairing season split up into small parties consisting of one old ram and several ewes. Mr. Buxton speaks of never having seen more than a dozen in company ; and also states that the old rams were sometimes solitary, but more often in small companies by themselves, while the young rams generally went about with the ewes. During December and January the old rams are much given to fighting among themselves. In April or May the ewes give birth to their young, of which there may be either one or two at a time ; and these are able to run with their mothers within a few days of their appearance in the world. If sufficiently hung, the flesh of the rams is excellent for the table when the animals are in good condition ; but in the latter part of the winter they become excessively lean, and the quality of the meat is then inferior. As is the case with the bharal, the meat is probably in its best condition about September. Muflon will breed with domesticated sheep.

Mr. Buxton's account in *Short Stalks* of the muflon in its native haunts is so excellent that it may be quoted *in extenso* :—“ Though he lives on ground more or less steep, it is easy, and he has no occasion for any remarkable feats of agility. On the other hand, his best safeguard lies in the dense *macquia* which covers the hills. At this elevation it is exclusively composed of the tall ‘bruyère’ heather, from which the so-called ‘briar-root’ pipes are made. This grows from two to six feet high. If this covert were continuous, it would of course be impossible to see an animal which stands little over two feet, but much of it has been burnt, and there are natural openings beside. It is in these openings that he must be sought when feeding. As all wild sheep are constitutionally restless, and never remain long in one place, it will be understood how difficult it is, even when they have been spied, to hold them with the glass. They are constantly disappearing in the *macquia*, and have to be refound again and again before a stalk can be successfully effected. When they are alarmed or ‘at gaze,’ they have a habit, or at least the rams have, of placing them-

selves in the middle of a bush of *macquia*, or in the shadow which it casts. The ewes, who are naturally less conspicuous, do this in a less degree. The muflon are also assisted by the wonderful alertness of their eyes. I do not think that they see at a great distance, but they detect an exceedingly slight sign at a moderate range. . . . When startled they whistle as a chamois, and as a Highland sheep occasionally does."

2. THE ASIATIC MUFLON—*Ovis orientalis*

Ovis musimon orientalis, Brandt and Ratzeburg, *Med. Zool.* vol. i. p. 54 (1829).

Ovis gmelini, Blyth, *Proc. Zool. Soc.* 1840, p. 69 ; Brooke, *ibid.* 1875, p. 526 ; Blanford, *Eastern Persia*, vol. ii. p. 88 (1876) ; Danford and Alston, *Proc. Zool. Soc.* 1877, p. 276, 1880, p. 55 ; W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 139 (1891) ; Ward, *Records of Big Game*, p. 258 (1896) ; Satunin, *Zool. Jahrb. Syst.* vol. ix. p. 312 (1896).

Ovis orientalis, Keyserling and Blasius, *Wirbelthiere Europ.* p. 29 (1840) ; Wagner, Schreber's *Säugethiere*, vol. iv. p. 507 (1844) ; Nehring, *Zool. Garten*, vol. xxviii. p. 378 (1887).

Ovis (Musimon) orientalis, Gray, *Knowsley Menagerie*, p. 36 (1850).

Caprovis (Musimon) orientalis, Gray, *Cat. Ungulata Brit. Mus.* p. 172 (1852), *Cat. Ruminants Brit. Mus.* p. 56 (1872).

Ovis anatolica, Valenciennes, *CR. Ac. Paris*, vol. xliii. p. 65 (1850).

Caprovis orientalis, Gray, *Hand-list Ruminants Brit. Mus.* p. 131 (1873).

Characters.—Typically of larger size than the European muflon, the height at the shoulder reaching to about 2 feet 9 inches. Females hornless. Horns of males rather large, curving at first outwards, upwards, and slightly backwards, and then backwards, downwards, and inwards, so that their tips are situated over the withers, instead of curving forwards below the eyes ; the spiral usually forming only about one half of a circle ;

transverse wrinkles on the front and lateral surfaces usually bold and widely separated, but becoming approximated in old animals ; inner front angle always well developed, but the outer one either distinct or completely rounded off. General colour of upper-parts some shade of russet-yellow or foxy-red, with the under-parts and lower portion of the legs white, but lacking most of the black markings of the male European muflon. There is, however, a dark mark on the fore-legs above the knees, a darkish stripe on the chest and flanks, and more or less indistinct traces of a light saddle-mark in the adult rams. Typically the neck thick, with a fringe of elongated hairs on the throat. Face-glands well developed.

Distribution.—The mountains of Elburz in Northern Persia, of Armenia, the Taurus range of Asia Minor, and the central chain of Cyprus.

a. ARMENIAN RACE—*Ovis orientalis typica*

Characters.—Size relatively large, the height at the shoulders reaching to 2 feet 9 inches. Horns of adult rams generally with the front outer angle well marked, so that the front surface is clearly defined from the outer one. Neck thick and bushy. General colour of head and upper-parts of adult male russet-yellow or foxy-red ; under-parts and lower portion of legs white ; a space before the eyes, nose, chin, and the inner surfaces of the ears whitish ; a dark purple-brown mark above the knees on the fore-legs, and a darkish streak down the chest ; the ridge of the neck and back somewhat darker than the rest of the upper-parts. In older males the general colour reddish, with a whitish saddle-mark.

Specimens of this sheep are rare in collections, and I have had to depend for the description of the coloration entirely upon the writings of others, as I have never seen a perfect skin. The British Museum possesses the skull and horns of a male, with some portions of the skin,

from Erzerum, forming the type of Blyth's *Ovis gmelini* (No. 55, 12, 24, 396), and presented by the Zoological Society in 1855. Also a complete skeleton presented by Mr. Danford. In both these the horns are of average dimensions; but the museum also possesses a skull, said to be from an island in the Mediterranean, and presented by Mr. W. B. Baker, in which the horns are greatly larger than in any other known example, and are further characterised by the great number and fineness of the transverse wrinkles. The latter is, however, a character which tends to be developed at the base of horns of old individuals; and as the pair under consideration agree in form and curvature with normal examples of the present species, there seems every reason for referring them to it, although they may possibly indicate a distinct race. The dimensions of this magnificent specimen occur first in the list following. Although the distinct development of the front inner edge is in general a marked feature of the horns of the mainland race, Messrs. Danford and Alston describe specimens which approximate both in this respect and in curvature to the Cyprian form.

Mr. Rowland Ward records the following horn-measurements:—

Length on Outer Curve.	Basal Circumference.	Tip to Tip.
$40\frac{1}{4}$	$10\frac{1}{2}$	$5\frac{1}{2}$
$36\frac{1}{4}$	$10\frac{3}{8}$	$5\frac{3}{4}$
$30\frac{1}{2}$	$10\frac{5}{8}$	18
$26\frac{1}{10}$	$8\frac{1}{2}$	$12\frac{1}{5}$
24	$9\frac{5}{8}$	17

Some degree of confusion has arisen among zoologists as to whether *O. orientalis* or *O. gmelini* is the proper name for this sheep. In 1876 Mr. W. T. Blanford¹ wrote as follows on this question: "No such name as *O. orientalis* was given to this sheep by J. G. Gmelin; he simply called it in German the Oriental sheep (*das orientalische Schaf*), and apparently

¹ *Eastern Persia*, vol. ii. p. 88.

considered it the same as the argali of J. G. Gmelin (*O. ammon*, Linn.). The name *O. orientalis* appears to have been first given, as from Gmelin, by Keyserling, and Blasius in the *Wirbelthiere Europas*. The date on the title-page of that work is 1840, and in the same year Mr. Blyth published the name *O. gmelini*, which should, I think, be retained for the species, since Keyserling and Blasius's title is erroneously quoted as Gmelin's."

So far as it goes, this passage is perfectly correct, but the author appears to have been unacquainted with Brandt and Ratzeburg's *O. musimon orientalis*, which antedates the names given both by the English and German zoologists mentioned above, and is therefore, so far as the third name is concerned, entitled to stand for the species.

The *Ovis musimon orientalis* of Brandt and Ratzeburg is stated to inhabit the Armenian mountains of Persia, the Greek Islands, Cyprus, and probably the Taurus, and to be distinguished from *O. musimon occidentalis* by the backward and inward inclination of the tips of the horns. As Persia is mentioned before Cyprus, the name evidently belongs to the Armenian rather than to the Cyprian variety.

Distribution.—The mountains of Elburz in Northern Persia, those of Armenia, and the Taurus range of Asia Minor. In Transcaucasia (Armenia) Dr. Satunin states that this sheep occurs in the neighbourhood of Kars and Eriwan, but extends some distance farther north.

Habits.—Messrs. Danford and Alston write as follows concerning this sheep:—"It seems hardly ever to occur on the southern slopes of the Taurus, preferring the barer districts of the north. Herr Kotschy, otherwise so accurate in his observations, must have been misled into stating that ten to twenty wild sheep are killed yearly at Gallek, as at that place, which is situated on the south side of the Bala Dagħ, we were assured that the species is not found. Specimens were obtained from the district of Eregli, where they are common, and frequent the salt-licks in large flocks. Winter is the easiest time of year to get at

them, the deep snow which generally covers that part of the country impeding their movements. At other times they are shy, and, owing to the scarcity of covert, very difficult to approach. The severe winter of 1873-74, which was so fatal to the tame breeds of sheep, also destroyed a great number of the wild species. Gmelin's sheep is a very graceful animal, deer-like in its appearance, having long, fine limbs, and in the male a thick, bushy throat."

b. CYPRIAN RACE—*Ovis orientalis ophion*

Ovis ophion, Blyth, *Proc. Zool. Soc.* 1840, p. 69; Brooke, *ibid.* 1875, p. 526; Alston and Danford, *ibid.* 1880, p. 59; Biddulph, *ibid.* 1884, p. 594, pl. lxviii.; Langkavel, *Zool. Garten*, vol. xxxii. p. 183 (1891); Ward, *Records of Big Game*, p. 256 (1896).

Ovis cyprius, Blasius, *Säugethiere Deutschlands*, p. 473 (1857).

Caprovis ophion, Gray, *Cat. Ruminants Brit. Mus.* p. 56 (1872).

Characters.—Smallest of all wild sheep, the height at the shoulder being only about $26\frac{1}{4}$ inches. Horns of male with the outer front angle so completely rounded off that the outer and front surfaces are merged into one; entire horns less massive and more slender than in the typical race, and also curving more regularly from base to tip, with the transverse wrinkles less fine. General colour of upper-parts bright foxy-red or rufous-fawn, with a few scattered whitish hairs on the sides of the body forming an incipient saddle-mark; a line down the middle of the withers, a band on the flanks continued on to the thighs, the tip of the upper surface of the tail, a broad streak down the middle of the chest, showing a tendency to develop into a patch on the lower part of the throat, front of fore-legs above the knees, and a patch on the inner side of the thighs above the hocks black or blackish; under-parts, a narrow line on the buttocks, the inner surfaces of the thighs and of the fore-legs above the knees, as well as the whole of the legs below the knees and hocks, together

with the muzzle, chin, and throat, white; upper part of nose and area in front of the eyes dusky-brown; ears gray externally, white internally. Face-glands small.

The above description is taken from an adult mounted male presented to the British Museum by Colonel John Biddulph. With the exception of the form of the horns, the animal reminds one of a European muflon, with most of the black points and the saddle-mark either wanting or



FIG. 31.—Head of male Cyprian Muflon. (From Biddulph, *Proc. Zool. Soc.* 1884.)

greatly reduced in size. And it may be observed that the curvature of the horns, as in the typical race, recalls to some extent that which obtains in those of the bharal, thus indicating that the latter is not quite so aberrant in this respect as is generally considered to be the case. The type specimen of this race is preserved in the museum at Berlin.

The following horn-measurements are given by Mr. Rowland Ward:—

Length along Front Curve.	Basal Circumference.	Tip to Tip.
24	8	$4\frac{1}{2}$
$23\frac{1}{2}$	$8\frac{1}{5}$	$12\frac{1}{4}$
23	7	$5\frac{3}{4}$
$22\frac{7}{8}$	$7\frac{1}{4}$	6
$22\frac{1}{4}$	8	$12\frac{3}{4}$
$17\frac{1}{2}$	8	$1\frac{1}{2}$

Although the complete rounding-off of the outer front angle of the horns is considered distinctive of the Cyprian race, Messrs. Alston and Danford, as mentioned above, have recorded examples of the typical mainland race in which the same feature is displayed, so that the two forms are evidently very closely allied.

Distribution.—The Troödos Mountains of Cyprus. These mountains form the western central portion of the island, with their central peak rising to a height of 6500 feet above the sea-level. “Here,” writes Col. Biddulph, “the wild sheep have a considerable area of pine-clad mountain to wander over, disturbed only by occasional wood-cutters and peasants herding goats and sheep. At the time of the first occupation in 1878 it was supposed that the wild sheep had been exterminated with the exception of a single flock of twenty-five members, and a check was placed on their slaughter. Since then their numbers have increased, and it may be hoped that under modified restrictions muflon-stalking in Troödos may long continue to be one of the sports of Cyprus.”

3. THE PLISTOCENE MUFLON—*Ovis savini* (*Extinct*)

Caprovis savini, Newton, *Geol. Mag.* decade 2, vol. vii. p. 449 (1880), *Vertebrata of Forest-Bed* (*Mem. Geol. Surv. United Kingdom*), p. 49, pl. x. (1882), *Vertebrata of Pliocene Deposits of Britain* (*Mem. Geol. Surv. United Kingdom*), p. 22 (1891).

Ovis savini, Lydekker, *Brit. Mamm.* (Allen's *Nat. Library*), p. 309 (1895).

Characters.—Founded upon the imperfect right half of a frontlet with the greater portion of the horn-core attached, now in the British Museum. In size and general curvature this specimen agrees very closely with the corresponding portion of the skull of the Armenian race of the Asiatic muflon, to which species it seems probable that the Pleistocene wild sheep

was allied. In the fossil skull the posterior surface of the horn-core is marked by a series of deep flutings, not observable in the existing kind. The outer front angle is, moreover, much less prominent, but as this is a feature observable in the Cyprian muflon, it would not appear to be of any very great distinctive value.

Distribution.—The east of England (and probably other parts of Europe) during the earlier portion of the Plistocene period.

4. THE SHA, OR URIAL—*Ovis vignei*

Ovis vignei, Blyth, *Proc. Zool. Soc.* 1840, p. 70; Gray, *List. Mamm.*



Brit. Mus. p. 169 (1843); P. L. Sclater, *Proc. Zool. Soc.* 1860, p. 127, pl. lxxix.; Brooke, *ibid.* 1875, p. 526; Sterndale, *Mamm. India*, p. 435 (1884); Blanford, *Fauna Brit. India — Mamm.* p. 497 (1891); W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 138 (1891); True, *Proc. U. S. Mus.* vol. xvii. p. 5 (1894); Ward, *Records of Big Game*, p. 250, 1896.

FIG. 32.—Head of male Ladak Sha. (Rowland Ward, *Records of Big Game*.)

Ovis (Musimon) vignei, Gray, *Knowsley Menagerie*, p. 36 (1850).

Caprovis (Musimon) vignei, Gray, *Cat. Ungulata Brit. Mus.* p. 172 (1852), *Cat. Ruminants Brit. Mus.* p. 55 (1872).

Ovis montana, Cunningham, *Ladak*, p. 199 (1854), *nec* Cuvier, 1817.

Musimon vignei, Gervais, *Hist. Nat. Mamm.* vol. ii. p. 191 (1855).

Caprovis vignei, Adams, *Proc. Zool. Soc.* 1858, p. 526; Gray, *Hand-list Ruminants Brit. Mus.* p. 130 (1873).



SALT-RANGE URIAL.

Plate XIII.

Characters.—Size medium, the height at the shoulder varying from 32 to 36 inches ; both sexes horned ; the face-pits in the skull large. Adult males with a more or less developed ruff of long hair on the throat, commencing as two large tufts on each side of the chin, but soon uniting, and extending downwards to the chest. Horns of male arising close together on the head, curving in a circular form at first backwards and outwards, and then forwards and inwards, so that their tips come more or less nearly below the line of the eyes ; the curvature in some cases almost or completely in one plane, but in other instances forming a spiral, very seldom exceeding a circle ; all the three surfaces marked with coarse transverse wrinkles, varying in distance from one another either individually, or according to age and locality ; the two front angles more or less distinctly marked, in some cases forming prominent nodose beads, between which the front surface is concave. Horns of female short and nearly straight. Colour of upper-parts rufous-brown or gray in summer, light grayish-brown in winter ; tail, buttocks, limbs, and under-parts white or whitish ; throat and chest ruff in some cases black throughout, but usually with some white hairs, and in old rams of one race entirely white in front passing into black at the base ; muzzle in old animals white or whitish ; a black or brownish-black patch behind each shoulder, and in some cases a line on the flanks and markings on the outer side of the limbs also blackish-brown.

The following are some of the largest horn-measurements recorded by Mr. Rowland Ward in the 1896 edition of *Records of Big Game* :—

Length along Front Curve.	Basal Circumference.	Tip to Tip.	Locality.
$39\frac{1}{2}$	$10\frac{3}{4}$	$18\frac{1}{4}$	Punjab
39	$11\frac{3}{4}$	$15\frac{1}{2}$	?
$38\frac{5}{8}$	$12\frac{1}{4}$	$11\frac{1}{4}$	?
$37\frac{1}{2}$	$10\frac{1}{4}$	11	?
$35\frac{1}{2}$	$10\frac{1}{2}$	16	Afghanistan
$35\frac{1}{4}$	$10\frac{1}{2}$	$9\frac{1}{2}$	Punjab
35	$11\frac{1}{2}$	14	Afghanistan
$33\frac{3}{4}$	$12\frac{1}{4}$	?	Ladak
$33\frac{1}{8}$	$11\frac{1}{2}$	$10\frac{5}{8}$	"
33	$10\frac{1}{2}$	15	"
$32\frac{1}{2}$	10	$11\frac{1}{2}$	?
$32\frac{3}{8}$	$7\frac{3}{4}$	12	Punjab
$32\frac{1}{4}$	10	$11\frac{1}{2}$	?
32	11	$9\frac{3}{4}$	Ladak
$31\frac{3}{4}$	$10\frac{1}{4}$	7	"
31	$10\frac{1}{4}$	?	Punjab
31	$9\frac{3}{8}$	$14\frac{1}{2}$	"
$30\frac{3}{4}$	$11\frac{3}{4}$	$11\frac{1}{4}$	"
$30\frac{7}{8}$	$9\frac{7}{8}$	$20\frac{1}{8}$	"
$30\frac{1}{2}$	12	?	"
$29\frac{3}{4}$	$10\frac{1}{2}$	$16\frac{1}{2}$	Sind
$29\frac{1}{2}$	9	?	Punjab
$28\frac{1}{2}$	9	10	Baluchistan
$28\frac{1}{4}$	9	$15\frac{1}{2}$	Afghanistan

In regard to horn-measurements, Mr. Blanford, quoting from notes supplied by Mr. A. O. Hume, states that whereas horns of the Punjab and Sind urial scarcely ever exceed 10 inches in basal girth, those of the Ladak sha are sometimes between 11 and 12 inches in circumference. And he further observes that, judged by this test, "the typical *O. cycloceros* of Hutton is identical with *O. vignei*, and the smaller urial, if kept distinct, must bear a different name." The measurements given above indicate, however, that Punjab specimens may occasionally measure 11 or even 12 inches in girth; and there accordingly appears no necessity for replacing *cycloceros* by a new sub-specific title.

Distribution.—From Ladak, Zanskar, and apparently still more easterly districts in Northern Tibet through Astor and Gilgit to Russian Turkestan (Bokhara and Khiva), also throughout Afghanistan, Baluchistan, and Southern Persia, and likewise in the Punjab and Sind Trans-Indus Ranges, as well as in the Cis-Indus Salt Range of the Punjab. In Zanskar and Ladak this sheep is found at elevations of from 12,000 to 14,000 feet elevation, but in Sind at or near the sea-level, in districts where the summer temperature ranges exceedingly high.

Habits.—With such a wide variety of station it is not to be wondered at that this sheep varies to a certain extent in its habits according to locality. In Ladak and Zanskar it is found in open more or less barren valleys, where it may often be seen in numbers on the hillsides, at a great elevation above the sea-level. On the other hand, in the neighbourhood of Astor and Gilgit urial mainly confine themselves to the grassy tracts at moderate elevations below the belt of forest, which occurs high up on the hills and receives more rain than the ground below. In the Punjab Salt Range, Sind, Baluchistan, and Persia they frequent low hills or undulating ground much intersected by ravines and gullies, being more generally seen on scarped rocky hillsides than among bush and jungle. Many of the rocks in the Salt Range where urial are common consist of bright red marls and sandstones, against which the rufous coat of the sheep is almost invisible; and this local coloration of the rocks may be the reason that the Punjab urial is a brighter-coloured animal than the sha of Ladak. The number of ravines, separated from one another by narrow ridges of rock, coupled with the slight elevation above the sea-level, renders urial-stalking in the Salt Range far less fatiguing than the pursuit of any other kind of wild sheep accessible to Indian sportsmen. The number of individuals in a flock of urial varies from three or four to as many as about twenty or thirty; and although the rams frequently separate themselves during some part of the summer, both sexes are commonly found in company.

Although less active climbers than bharal and tahr, Punjab urial display a great amount of agility in getting over the rough ground which forms their haunts; and in this respect are decidedly ahead of the larger sheep of Central Asia. When alone, their call is a kind of bleat not unlike that of domesticated sheep, but when alarmed they utter a shrill whistle, at the same time stamping with their fore-feet. The period of gestation is probably about six months, the pairing season occurring in September in the Punjab, but apparently considerably later in Astor, where the young are born in June. There may be either one or two lambs at a birth; and the species will cross readily with domesticated sheep, while it has been known to breed with the Tibetan argali.

General A. A. Kinloch writes as follows of this sheep in the Punjab: "The urial is found among low stony hills and ravines, which are generally more or less covered with thin jungle consisting principally of thorny bushes. During the heat of the day the urial conceal themselves a good deal, retiring to the most secluded places, but often coming down to feed in the evenings on the crops surrounding the villages. Where not much disturbed they will stay all day in the neighbourhood of their feeding-grounds, and allow sheep and cattle to feed amongst them without concern, but where they have been much fired at they usually go long distances before settling themselves for the day. They are generally found on capital ground for stalking, the chief drawback being the stony nature of the hills, which renders it difficult to walk silently. When fired at, urial usually go leisurely away, stopping to gaze every now and then, so that several shots may be fired at one herd. . . . Urial appear to be partly migratory, as they are now plentiful where they were not so common formerly, and places that were once famous for them are now nearly deserted. This is doubtless in great measure caused by the way in which they are hunted and shot at, wherever they are known to be plentiful."

a. ASTOR RACE—OVIS VIGNEI TYPICA

Characters.—Size relatively large, the height at the shoulder reaching to 36 inches. Horns of male generally thick and forming a wide circle, with the tips more or less divergent; the front angles more or less rounded off, apparently never forming distinct beads, and the transverse ridges on the front surface never very coarse. Ruff on throat and chest apparently less developed than in the next race, and the summer pelage less distinctly red.

Specimens of the Astor and Ladak sha of different ages, and showing the pelage of the two seasons, are much required in English collections. There has been considerable discussion as to whether the horns can in all cases be distinguished from those of the Punjab race, and in some instances this is probably impossible. Nevertheless, I have not observed horns of this race bearing the distinct beads so frequently seen in those of the following one. It must be borne in mind that some of the skulls in the British Museum labelled Northern India may perfectly well have come from Ladak; and this may have been the cause of some confusion. Mr. W. L. Sclater states that the present race is redder than the Punjab form, but this I believe to be a mistake, specimens of the latter in the British Museum from Afghanistan and Peshawur being almost foxy-red in colour.

Distribution.—Typically from Astor, where it is known as the urin, but ranging into Zanskar, Ladak, and other parts of Tibet, where it is termed sha, the male having the special designation of shapo and the female of shamo. Eastwards the range extends through Gilgit to the borders of Afghanistan, where the typical sha probably intergrades with the true urial.

b. PUNJAB RACE—OVIS VIGNEI CYCLOCEROS

Ovis cycloceros, Hutton, *Calcutta Journ. Nat. Hist.* vol. ii. p. 514 (1842) ; P. L. Sclater, *Proc. Zool. Soc.* 1860, p. 128, pl. lxxx. 1887, p. 637 ; Jerdon, *Mamm. India*, p. 294 (1867) ; Kinloch, *Large Game Shooting*, pt. i. p. 29 (1869) ; Blanford, *Eastern Persia*, vol. ii. p. 87 (1876) ; Sterndale, *Mamm. India*, p. 435 (1884) ; Thomas, *Trans. Linn. Soc.* ser. 2, vol. v. p. 63 (1890) ; W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 138 (1891).

Ovis arkal, Blasius, *Säugethiere Deutschlands*, p. 469, figs. 243, 244 (1857).

Caprovis cycloceros, Gray, *Cat. Ruminants, Brit. Mus.* p. 55 (1872).

Caprovis arkal, Gray, *op. cit.* p. 56 (1872).

Characters.—Size smaller than in the typical race, the height at the shoulder seldom exceeding 32 inches. Horns usually slightly spiral, forming a less open and more compact circle, with the tips convergent, and thus approximated to the eyes ; the two front ridges frequently very strongly developed and forming distinct nodose beads, between which the front surface of the horn is concave and carries bold and widely separated transverse wrinkles. Ruff on throat and chest very strongly developed, and its upper front portion more or less completely white in old males.

That the urial, as this sheep is termed in the Salt Range and other districts of the Punjab, is not entitled to specific separation from the sha of Astor and Ladak, may be fully admitted ; but, at the same time, it seems to have a distinct claim to be regarded as a more or less well-marked small local race. I have never seen Astor or Ladak horns showing the prominent bead-like front ridges displayed in the old male from Afghanistan in the British Museum forming the subject of plate xiii. Although many other specimens display similar beads, and equally pronounced and widely separated transverse wrinkles on the front surface, it must not be supposed that these features are distinctive of all individuals of this race ; quite the contrary. For instance, in a younger mounted male specimen

from Peshawur in the British Museum the development of the two front ridges of the horns is comparatively slight, as is likewise the case in two older mounted heads from Afghanistan in the same collection. All that can be said is that similar prominent beads on the front angles of the horns, and similar bold transverse ridges on the surface between them, appear unknown in Astor and Ladak specimens. The differences cannot be explained by differences in age. The specimen figured in plate xiii. is a very old male, but some young specimens show equally strong front angles to the horns. On the other hand, the Peshawur specimen mentioned above, in which the front angles are but slightly developed, is an immature animal, while the heads in the British Museum from Afghanistan are those of old individuals. Horns of the latter type are, as Mr. Blanford points out, very difficult to distinguish from those of the Ladak sha ; and in some cases it may be impossible to refer specimens to their proper race.

It may be added that, in addition to the distinctive features indicated above, very different physical conditions obtain in the typical habitats of the two ; the Astor and Ladak animal dwelling at very high elevations, where the winter temperature is of excessive severity, whereas the other form occurs in the hot low ranges of the Punjab, Sind, and neighbouring districts.

The sheep described under the name of *Ovis arkal* comes from the Turkoman country, on the eastern precincts of the Caspian—that is to say, from the neighbourhood of Khiva or Bokhara. Where the type skull figured by Blasius is preserved, I have no means of knowing ; but the skull and horns of a ram in the British Museum (No. 94, 5, 31, 2) from the Turkoman country agrees with the figures given by Blasius, and doubtless belongs to the same form. It is clearly referable to the present species, and as it shows the strongly marked and beaded front angles and bold transverse ridges found in many horns of the Punjab race, coupled with the fact that it is the latter which inhabits Afghanistan and Persia, it

appears most probably that the Turkoman sheep is inseparable from the race inhabiting the former districts.

Distribution.—Typically the Salt Range of the Punjab, but extending to the Cis-Indus Ranges of the Punjab and Sind, and thence into Afghanistan, Southern Persia, and apparently Russian Turkestan.

c. KELAT RACE—*Ovis vignei blanfordi*

Ovis blanfordi, Hume, *Journ. As. Soc. Bengal*, vol. xlv. p. 327, pl. iv. (1887); P. L. Sclater, *Proc. Zool. Soc.* 1887, p. 639.

Characters.—Horns of male relatively large, with the two front angles distinct, and the curve forming an open spiral, instead of lying almost or quite in the same plane, as in the two preceding races; the tips being thus very much further apart than is the case in the latter. Pelage apparently unknown. The following dimensions of the type specimen are given by Mr. Hume, the figures in the second column indicating the corresponding measurements of a fully adult skull of the Punjab race:—

Length of horns along the curve . . .	$35\frac{3}{4}$	$29\frac{1}{2}$
Basal circumference of same . . .	9	10
Interval between tips . . .	$16\frac{1}{2}$	$5\frac{1}{2}$
Greatest breadth of horn at base . . .	$2\frac{1}{4}$	$2\frac{1}{2}$
Greatest depth of horn at base . . .	$3\frac{1}{4}$	$3\frac{1}{4}$

Distribution.—The neighbourhood of Kelat, in Northern Baluchistan.

5. THE ARGALI—*Ovis ammon*

Capra ammon, Linn. *Syst. Nat.* ed. 12, vol. i. p. 97 (1766); Fischer, *Synop. Mamm.* p. 487 (1829).

Ovis argali, Pallas, *Spicil. Zool.* fasc. xi. p. 20 (1777-80); Blasius, *Säugethiere Deutschlands*, p. 468 (1857); Radde, *Reise Öst.-Siber.* p. 236



SIBERIAN ARGALI.

(1862); Severtzoff, *Trans. Soc. Moscou*, vol. viii. art. 2, pp. 150 and 154 (1873).

Ovis ammon, Erxleben, *Syst. Nat. Mamm.* p. 250 (1777); H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 317, v. p. 359 (1827); Brooke, *Proc. Zool. Soc.* 1875, p. 518; Blanford, *ibid.* 1896, p. 787; Ward, *Records of Big Game*, p. 243 (1896).

Ægoceros argali, Pallas, *Zoogr. Rosso-Asiat.* vol. i. p. 231 (1811).

Ovis (Argali) argali, Gray, *Knowsley Menagerie*, p. 37 (1850).

Caprovis (Argali) argali, Gray, *Cat. Ungulata, Brit. Mus.* p. 174 (1852), *Cat. Ruminants, Brit. Mus.* p. 57 (1872).

Musimon argali, Gervais, *Hist. Nat. Mamm.* vol. ii. p. 191 (1855).

Caprovis argali, Gray, *Hand-list Ruminants, Brit. Mus.* p. 132 (1873).

Plates XIV. and XV.

Characters.—Size largest of all living sheep, the height at the shoulder reaching from 3 feet 9 inches to 4 feet, and the build proportionately stout. Horns of adult male exceedingly massive, their basal girth being very great and both the front and lateral surfaces relatively broad; frequently both the inner and outer front angles rounded off near the base, and the transverse wrinkles numerous and closely approximated, with the intervening grooves deep, and strongly developed both on the front and lateral surfaces; in some cases, and more especially in the Tibetan race, the horns with the front angles much more distinct; curvature of the horns forming a spiral varying from somewhat less to considerably more than one complete circle. In females the horns short, erect, curving backwards and outwards, and becoming thin and strap-like near the tips. Hair short, coarse, and close in winter; in summer, especially in old rams, still shorter and much thinner; in some cases a ruff on the throat. General colour of upper-parts light brown in winter, mingled brown and white in summer, at least in old

males ; a more or less distinct white disk on the buttocks of the rams ; the face, more or less of the under-parts, the inner surfaces of the legs and their front surfaces below the knees and hocks white ; outer surface of thighs dark like the back.

This species, which, although originally named by Linnæus, was first adequately described by the Russian naturalist Pallas on the evidence of specimens obtained from Siberia, is the typical representative of that exceedingly difficult and still very imperfectly known group of large Asiatic sheep to which the name of argali may be collectively applied. If, as some sportsmen have suggested, all these great sheep are nothing more than local races of one very variable species, the name *Ovis ammon* will be the one which will have to stand. There seem, however, to be at least three well-marked types of large wild sheep in Central and Northern Asia, severally represented by *Ovis ammon*, *O. poli*, and the Kamschatkan race of the bighorn. And as I cannot satisfy myself that the two former pass into one another, while they are certainly distinct from the latter, I think it better, for the present at any rate, to regard them as distinct species, with fewer or more local races.

The general characters of the horns of adult rams of the typical race of *O. ammon* are so different from those of the adult *O. poli* that there is never any difficulty in distinguishing between the two animals, which are further differentiated by colour, the former having the outer surface of the thighs coloured like the back, while in the latter it is white. In the Tibetan race, where the horns are often more angulated, they are always much more massive than those of *poli*, as well as considerably shorter. If intermediate forms between the *ammon* and *poli* types are to be looked for anywhere, it is in the Altai, where they would most likely be found, since the typical race of the former ranges into the northern districts of that area, while a variety of the latter inhabits the more southern parts. And in the British Museum there are certain Altai sheep referred to below which in

regard to their horns are to a certain extent intermediate between the typical *ammon* and the variety of *poli* named *karelini*. But these sheep are in colour so different from both that, in the present state of information, it appears desirable to keep them apart.

The weight of males of the Tibetan race has been estimated to reach from 250 to 350 lbs.; one specimen is known to have weighed 205 lbs., and a second 212 lbs.

Distribution.—The countries bordering the Gobi Desert, being definitely known from Mongolia, north of Peking, through Eastern Siberia and Northern Mongolia to the Semipalatinsk Altai, and thence through the Kuenlun, and perhaps the district north of the Mustag, to the Tibetan plateau. Although it is not definitely ascertained that the range is continuous from North-Eastern Mongolia to the Kuenlun, yet it is most probable that this will be found to be the case. Apart from this, it seems fairly evident that the distributional area of the *ammon* type forms a hollow ellipse, or perhaps a horse-shoe, on the north-western border of which are situated the districts inhabited by the *poli* type and the sheep here called *O. sairensis*.

a. SIBERIAN RACE—OVIS AMMON TYPICA

Ovis argali altaica, Severtzoff, *Trans. Soc. Moscou*, vol. viii. art. 2, p. 154 (1873).

Ovis argali mongolica, Severtzoff, *loc. cit.*

Plate XIV.

Characters.—Size very large, the dimensions being the maximum attained by the species. Horns of male very massive, long, and curving much outwards at the tips, which are generally entire, so as to form

considerably more than a complete circle ; usually both front angles much rounded off. Hair on sides and under surface of the neck in males only slightly elongated, and not forming a distinct ruff. Pelage in winter with the hairs close and about an inch in length ; general colour of the upper-parts uniformly light brown tinged with gray ; face, abdomen, a disk on the buttocks, the inner side of the legs and their front surfaces below the

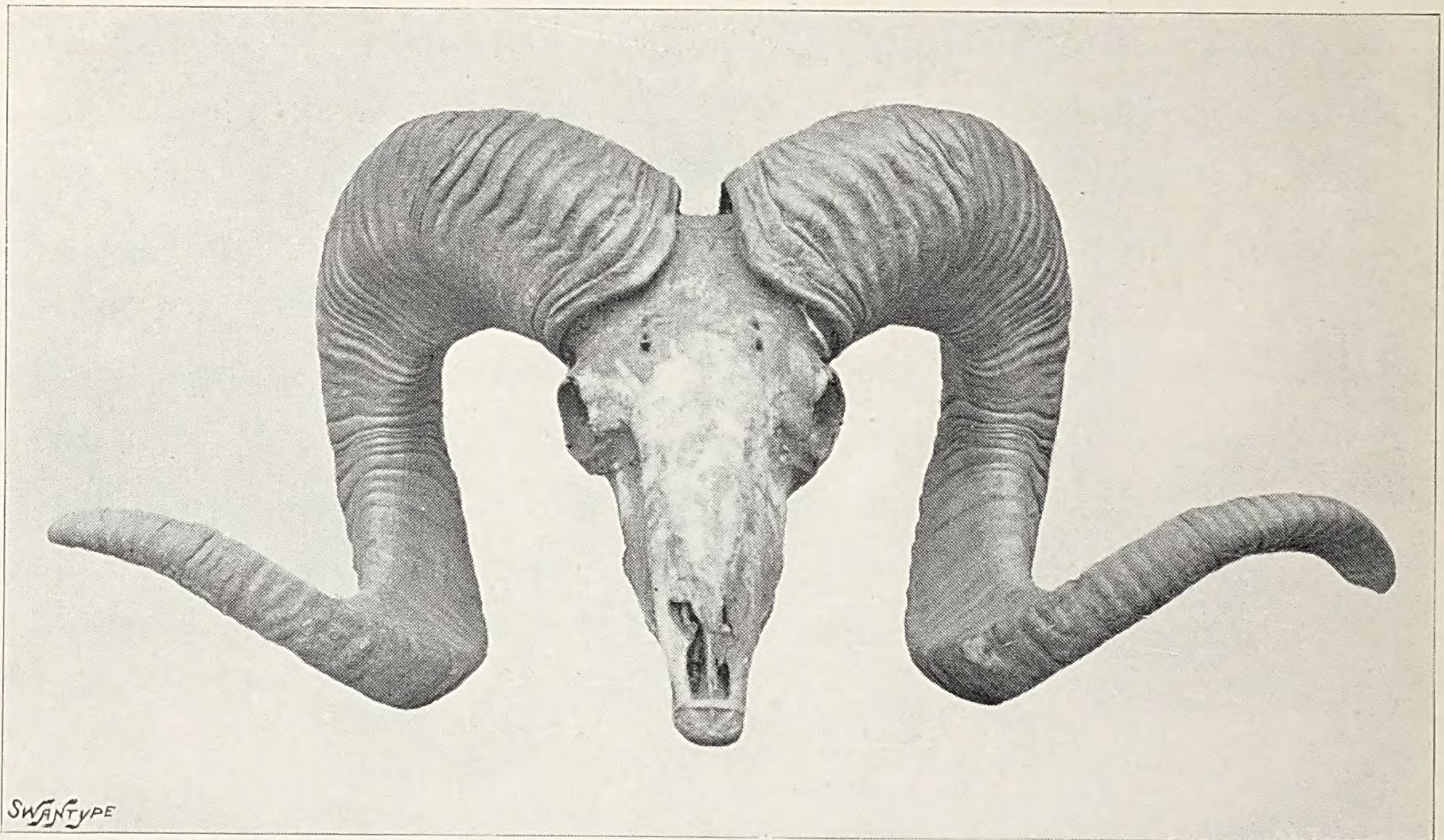


FIG. 33.—Skull and horns of male Siberian Argali. From a specimen shot by Mr. Littledale in the Altai.

knees and hocks white ; anterior portion of under surface of body darker than the back ; no dark stripe on the nape of the neck and withers. In summer the hair much shorter and less dense, and the whole colour much lighter, all the upper-parts being uniformly speckled brown and white, becoming lighter on the face, throat, chest, under-parts, and limbs, the caudal disk being only slightly lighter than the back.

The above description is taken from a mounted male specimen, with the winter pelage, in the British Museum, purchased many years ago from

the late Dr. Brandt, and stated to come from Siberia ; and secondly, from a male in the summer coat shot by Mr. St. George Littledale in the Semipalatinsk Altai, and presented by him to the Museum. It is this second specimen that forms the subject of plate xiv. In addition to several skulls, the Museum also possesses a mounted male head shot by Major C. S. Cumberland in the district east of Semipalatinsk (about lat. 50° N., long. 88° E.), which has been described and figured by Mr. Blanford on page 787 of the Zoological Society's *Proceedings* for 1896. This specimen, which is in summer pelage and fully adult, exhibits in great perfection the slight angulation of the bases of the horns and the numerous wrinkles with deep grooves between them so characteristic of the species and race. An adult skull also presented to the Museum by Major Cumberland, and now mounted on the wall to the left of the large sheep-case, has the front angles of the horns sharp, and it does not appear that this difference can be accounted for by immaturity.

The dimensions of the four largest pair of horns obtained by Major Cumberland are as follows :—

Length along Front Curve.	Basal Circumference.	Tip to Tip.
$56\frac{1}{2}$	$18\frac{1}{2}$	$33\frac{1}{2}$
$54\frac{3}{4}$	$18\frac{3}{4}$	30
$54\frac{1}{2}$	19	35
$54\frac{1}{2}$	$19\frac{3}{4}$	$33\frac{3}{4}$

Distribution.—Imperfectly determined, but apparently in former times extending from the Baikal Mountains in the south of Eastern Siberia through Northern Mongolia to the Semipalatinsk Altai. In the latter locality it is still abundant, and inhabits an undulating plateau at an elevation of from 6000 to 10,000 feet above the sea-level ; but from the greater part of Eastern Siberia it appears to have been exterminated and driven south by the Cossacks. In Northern Mongolia it still survives ; and to the eastward not improbably intergrades with the next race. In Siberia

and Mongolia it lives at comparatively low elevations above the sea-level.

Habits.—Although the habits of this sheep are doubtless in the main very similar to those of the Tibetan race, a note by Mr. St. George Little-dale with regard to one trait is worthy of quotation. This passage is as follows :—“The sheep’s habit of disappearing in cavities and under rocks from 10 A.M. until evening made the sport less interesting than the pursuit of *Ovis poli*, who is always ‘on view,’ and even when hard hit the extraordinary vitality of the beast not unfrequently enables him to escape the hunter.”

b. MONGOLIAN RACE—*Ovis ammon jubata*

Ovis jubata, Peters, *Monatsbericht Akad. Berlin*, 1876, p. 117, pls. i.–iv. ; Prezewalski, *Cat. Zool. Coll.* p. 15 (1887).

Characters.—Apparently nearly allied to the Tibetan race, having horns of a very similar type, and a distinct throat-ruff, which, like the face, is yellowish-white. The white on the buttocks and hinder surfaces of the legs is, however, more abundant and of a purer tint even than in the Siberian race, the tail being wholly pure white.

Distribution.—Eastern Mongolia, to the north of Peking. This sheep is known to me only by the description and plate in Peters’s memoir.

c. TIBETAN RACE—*Ovis ammon hodgsoni*

Ovis hodgsoni, Blyth, *Proc. Zool. Soc.* 1840, p. 65 ; P. L. Sclater, *ibid.* 1860, p. 129 ; Severtzoff, *Trans. Soc. Moscou*, vol. viii. art. 2, pp. 151 and 154 (1873) ; Brooke, *Proc. Zool. Soc.* 1875, p. 520 ; W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 136 (1891) ; Blanford, *Fauna Brit. India—Mamm.* p. 494 (1891) ; Ward, *Records of Big Game*, p. 243 (1896).



TIBETAN ARGALI.

Ovis ammonoides, Hodgson, *Journ. As. Soc. Bengal*, vol. x. pp. 230 and 913 (1840-41), xv. p. 338 (1846); Hutton, *ibid.* vol. xvi. p. 568 (1847).

Ovis ammon, Horsfield, *Cat. E. Ind. Mus.* p. 176 (1851), nec *O. ammon*, Linn. 1766; Kinloch, *Large Game Shooting*, pt. i. p. 19 (1869); Blanford, *Journ. As. Soc. Bengal*, vol. xli. p. 40 (1872).

Caprovis argali, Adams, *Proc. Zool. Soc.* 1858, p. 527, nec *O. argali*, Pallas, 1777-80.

Ovis blythi, Severtzoff, *Trans. Soc. Moscou*, vol. viii. art. 2, p. 154 (1873).

Ovis brookei, E. Ward, *Proc. Zool. Soc.* 1874, p. 143; Brooke, *ibid.* 1875, p. 521; Sterndale, *Mamm. India*, p. 434 (1884), *Journ. Bombay Nat. Hist. Soc.* vol. i. p. 35 (1886), *Proc. Zool. Soc.* 1886, p. 205.

(?) *Ovis dalai-lamæ*, Prezewalski, *Cat. Zool. Coll.* p. 16 (1887).

Plate XV.

Characters.—The size but little less than in the typical race, the height at the shoulder ranging from about 3 feet 6 inches to at least 3 feet 10 inches.¹ The horns of males generally somewhat less massive, and forming a less open spiral, which does not exceed one complete circle and is usually less; their tips almost invariably broken, the wrinkles apparently slightly less prominent, and the outer front angle frequently distinct. In adult males the hair on the sides and lower surface of the neck elongated into a large whitish ruff, which apparently persists throughout the year; there is also a shorter crest of dark hair running along the back of the neck to the withers.

Apart from the whitish ruff, the general coloration is very similar to that of the typical race. The upper-parts are grayish-brown, the throat, chest, under-parts, and insides of the limbs, the front surface of the legs

¹ Mr. Blanford gives 4 feet as the maximum, but I am doubtful if this height is ever reached.

below the knees and hocks, as well as a small caudal disk in males, dirty white. The upper surface of the root of the tail has a dark mark ; and the caudal disk and white on the legs are less developed than in either of the preceding races, the fawn of the hind-legs sometimes extending completely round them above the hocks. In old males, probably in



FIG. 34.—Head of male Tibetan Argali. From a specimen shot by Col. Wade-Dalton.
(Rowland Ward, *Records of Big Game*.)

summer coat,¹ the back becomes grizzled, owing to the admixture of white with the brown hairs. The ewes have little or no mane, less of white on the limbs, and the caudal disk much more indistinct.

The following are some of the largest horn-measurements of this race given by Mr. Rowland Ward in the edition of 1896 :—

¹ Mr. Blanford suggests that this sheep is darker in summer than in winter, but this is certainly not so in the case of old rams.

Length along Front Curve.	Basal Circumference.	Tip to Tip.
$50\frac{1}{2}$	$18\frac{1}{4}$	19
$48\frac{1}{2}$	19	?
48	16	23
47	17	?
$46\frac{1}{2}$	$16\frac{1}{2}$	21
$46\frac{1}{2}$	$19\frac{3}{4}$	20
$46\frac{1}{2}$	$16\frac{3}{4}$	?
46	19	?
$44\frac{5}{8}$	$17\frac{1}{2}$	$22\frac{1}{2}$
$44\frac{1}{2}$	17	$21\frac{7}{8}$
44	$16\frac{1}{8}$	$19\frac{1}{4}$
$42\frac{1}{2}$	$16\frac{1}{2}$	19

In the male specimen forming the subject of plate xv. the front angles of the horns are distinct and strongly developed, but they are much more rounded off in the head represented in fig. 34. There appear indeed to be two sub-varieties of this race, differing in this respect, but whether these are confined to particular localities, I have no means of ascertaining. As already said, the development of the front angles of the horns appears, on the whole, to be decidedly more marked than in the Siberian race. The *Ovis blythi* of Severtzoff was founded on specimens of this sheep in which the outer front edge of the horns is rounded off.

Distribution.—The plateau of Tibet, from Northern Ladak to the districts north of Sikkim, and probably farther east; northwards it extends to the Kuenlun, and perhaps beyond the Mustag, while eastwards the range may extend along the southern border of the Gobi Desert to join that of the preceding race, with which the present form may intergrade. Unknown to the southward of the main axis of the Himalaya. In Western Tibet not found in summer below an elevation of about 15,000 feet above the sea-level, but in winter descending locally to some 12,000 or 1000 feet above the level of the town of Leh.

I am indebted to Dr. E. Büchner, of St. Petersburg, for the

information that *O. dalai-lamæ* is probably identical with the present race.

Habits.—Although I have seen large herds of ewes and young rams of the Tibetan race of this species, I have only once come across a full-grown ram, and my notes on its habits must consequently be taken from the writings of those who, like General A. Kinloch, have enjoyed more favourable opportunities for observation. I can, however, confirm the



FIG. 35.—Head of young male Tibetan Argali. (From Darrah's *Sport in the Highlanas of Kashmir.*)

testimony of others as to the magnificent appearance and carriage of the adult rams, and I can even now recall the sight of the individual I beheld standing on the top of a low pass in the Changchenmo district of Ladak. In the latter country during the winter these sheep inhabit the lower and more protected valleys, where snow does not accumulate to any great depth; but with the advent of summer the old rams separate from the flocks to resort to more secluded situations at higher levels. According to General Kinloch, these sheep are very particular in their choice of locality, resorting year after year to the same spots, and entirely neglecting other hills which apparently possess similar advantages with

regard to pasture and water. The open nature of the ground they frequent renders the old rams exceedingly difficult to stalk, and even when they resort to more broken ground, where the actual stalking is easier, their extreme wariness often defeats the most carefully laid plans of the sportsman. The breeding-season is in December and January, when the flocks are at a comparatively low elevation ; and the young are born about the following May or June.

6. LITTLEDALÉ'S SHEEP—*Ovis sairensis*

Characters.—Size smaller than in either *O. ammon* or *O. poli*, the height at the shoulder being about 3 feet 2 inches. Horns of adult male in some respects intermediate between those of the two species named, forming a close spiral of rather more than a circle ; decidedly more massive than in *poli*, with the front angles rounded off, and thus more like the typical race of *ammon*, although considerably smaller ; those of immature males distinctly angulated. General colour of the upper-parts of adult male in summer pelage full rufous-brown, becoming blackish-brown on hinder part of head, withers, loins, rump, tail, outer surface of thighs, and under-parts ; face, except muzzle, which is dirty white, gray-brown ; legs gradually more and more speckled with white hairs, till from just above the knees and hocks downwards they become white ; sides of head, neck, and throat speckled brownish-gray, becoming impure white in the middle of the chest. Immature males nearly uniform rufous-brown throughout. Females rufous-brown on the upper-parts, with a broad black streak extending from the back of the head to the loins, and widening into a patch in the neighbourhood of the withers ; under-parts and legs nearly white. In the adult male the horns, of which the tips are broken, measure $46\frac{1}{2}$ inches along the front curve, with a basal girth of about $15\frac{1}{4}$ inches, and an interval of 27 inches between the tips. The basal girth of the horns is

absolutely greater than in specimens of *O. poli karelini*, with horns of greater length.

Distribution.—The Sair, or Saiar Mountains, situated in the Great Altai on the north-western border of Mongolia, nearly due east of a point midway between the Semipalatinsk and the Semirechinsk Altai, in latitude

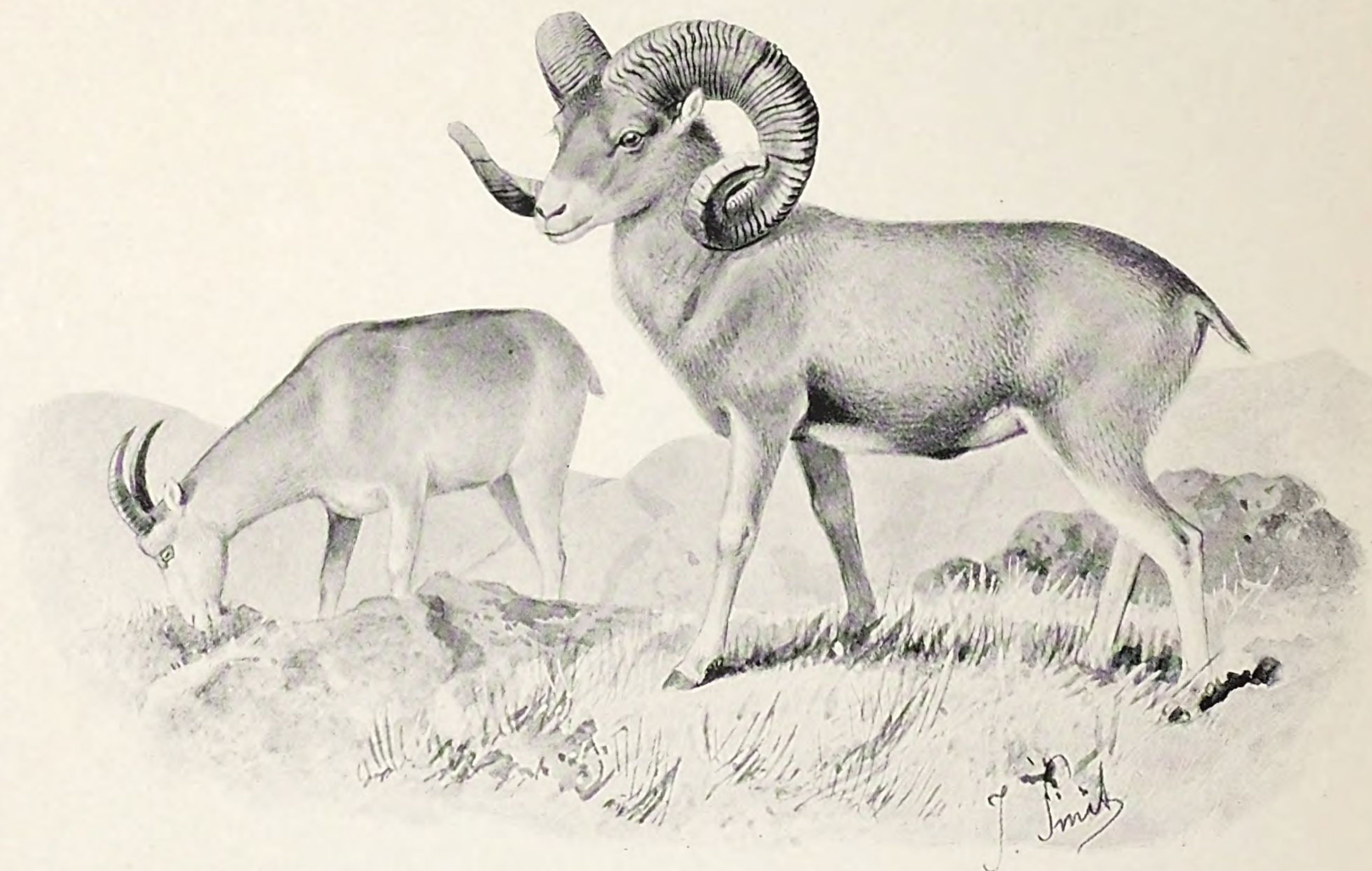


FIG. 36.—Little's Sheep. From the type specimen in the British Museum.

86° E. longitude 47° N. Also at Semitau, north of the Jair, or Jaiar Mountains,¹ lying in latitude 84° E. and longitude 46° N. The distributional area therefore lies a little to the eastward of the line approximately dividing the habitat of *O. ammon typica* from that of *O. poli karelini*, and impinging on the eastern boundaries of both.

Comparisons.—This sheep is typified by three specimens (Nos. 90, 4, 30, 3-5) in the summer pelage presented to the British Museum by Mr. St.

¹ Marked in Map 77 (F. 1) of the *Times Atlas*.

George Littledale, who shot them in the Sair Mountains. They include an adult and an immature male and an adult female, the first of which may be taken as the actual type. It is, moreover, most probable that a skull (No. 91, 6, 17, 1) presented to the Museum by the same gentleman, and obtained from Semitau, north of the Jair Mountains, belongs to the same form.

That this sheep is distinct from all the three races of *O. ammon* referred to above seems to be beyond doubt. It clearly appears to be equally distinct from the typical race of *O. poli*, of which specimens in summer dress are available for comparison in the British Museum ; while Severtzoff's plate shows the winter coat, which is almost identical with that of *poli karelini*. So far as can be determined from comparison with specimens of *O. poli karelini* in winter dress, there seems also good evidence of distinctness from that form, although in the matter of coloration it comes nearer to that animal than any other ; both showing some brown on the upper part of the face and a dark streak down the back of the female. I cannot, however, think that *O. poli karelini* in its summer dress would have the dark under-parts and rump of the present form, while it certainly has not horns of the same massive type, and is altogether of larger bodily size. Moreover, if *poli karelini* became thus dark in summer, it would differ so much from *poli typica* as to be entitled to specific distinction. As already said, the horns are stouter than in *O. poli karelini*. As I cannot identify it with either of the insufficiently described sheep named by Severtzoff, and fail to see that it comes decidedly closer to *O. ammon* than to *O. poli*, I am fain, at least provisionally, to regard it as representing a separate species.

The summer coat of the adult male differs broadly from that of both *ammon* and *poli typica* by its darker colour, and more especially by the absence of a white caudal disk and by the dark under-parts. From *poli typica* it is further distinguished by the dark outer surface of the thighs ; while the females of both *ammon* and *poli typica* lack the broad, blackish dorsal stripe characterising that sex in the present form.

Of the sheep described by Severtzoff, *O. heinsi* and *O. nigrimontana* were named on the evidence of skulls alone. The former was obtained much more west than Mr. Littledale's sheep, coming from Tokmak, situated in the Southern Semirechinsk, between the Alexandrovski Mountains and the Alatau, and therefore within the distributional area of *O. poli*, of which, at most, it probably forms a race. *O. nigrimontana*, on the other hand, is from a point much south of the habitat of the present form, coming from the Karatau, or Black Mountains, lying to the south-west of Kulja,¹ and east of the Alatau. Living specimens seen at a distance by its describer are stated to have shown a white caudal disk and under-parts; and the small length of the horns in the type specimen (38 inches) is suggestive of affinity with the *ammon* type.

7. MARCO POLO'S SHEEP—*OVIS POLI*

Ovis poli, Blyth, *Proc. Zool. Soc.* 1840, p. 62, *Ann. Mag. Nat. Hist.* ser. 1, vol. vii. p. 195, pl. v. (1841); Severtzoff, *Trans. Soc. Moscou*, vol. viii. art. 2, pp. 150 and 154, pls. ii. and iii. (1873); Stoliczka, *Proc. Zool. Soc.* 1874, p. 425, pl. liii.; Brooke, *ibid.* 1875, p. 514; Biddulph, *ibid.* p. 157, *Proc. As. Soc. Bengal*, 1879, p. 280; Scully, *Proc. Zool. Soc.* 1881, p. 209; Blanford, *ibid.* 1884, p. 326, *Fauna Brit. India—Mamm.* p. 496 (1891); W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 133 (1891); De Poncins, *Journ. Bombay Nat. Hist. Soc.* vol. x. p. 53 (1895); Ward, *Records of Big Game*, p. 240 (1896).

(?) *Ovis arkar*, P. L. Sclater, *Proc. Zool. Soc.* 1874, p. 89.

Plate XVI.

Characters.—Height at shoulder probably only slightly less than in

¹ All these places are shown in Map 77 of the *Times Atlas*.



MARCO POLO'S SHEEP, PAMIR RACE.

*O. ammon*¹ and the build perhaps rather lighter. General characters very similar to those of the latter, but the horns thinner and frequently longer. Horns of adult male long, slender, and forming more than a complete circle; typically the front angles well developed, the wrinkles on the front surface placed rather far apart at the base of the horns, and those on the lateral surface frequently but slightly developed. Hair of summer pelage longer than in *O. ammon*; general colour of upper-parts of adult male in summer



FIG. 37.—Head of Pamir race of Marco Polo's Sheep. From a specimen in the possession of Mr. David T. Hanbury.

pelage light speckled brown; most or all of face, throat, chest, under-parts, buttocks, and legs white, the white extending largely on to the outer surface of the thighs; a black streak from the nape to the withers; no distinct ruff on the throat. In winter the hair considerably longer, and

¹ Major C. S. Cumberland, as quoted by Mr. Rowland Ward, states that this sheep grows to 4 feet at the shoulder, but Mr. Blanford, in his latest memoir on that species, speaks of *O. ammon* being probably the larger animal of the two, and I cannot find any record of its exceeding 4 feet. Mr. Littledale's male of *O. ammon* in the British Museum measures about 3 feet 9 inches as mounted, his *poli* 3 feet 5 inches, and his *sairensis* 3 feet 2 inches; but there may have been some shrinkage in the skins.

forming a well-marked white ruff on the throat and chest, and a darkish line of somewhat elongated hair extending from the nape to the withers ; the upper-parts showing a more or less rufescent tinge, especially towards the border of the dark area. In females the neck is brown in front in the winter pelage ; while in the summer coat there is typically no blackish stripe extending from the head to the root of the tail, although this is present, at least in the winter coat of the second race. Horns of female generally similar to those of *O. ammon*.

Twenty-two stone is given as the approximate weight of an adult ram.

The two points whereby this magnificent sheep may be most easily distinguished from its fellows are, firstly, the relative slenderness of the horns of the rams, which in the typical race are longer and extended more outwardly than in any other sheep ; and secondly, the large extent of white on the hind-quarters, which includes the greater part of the outer surface of the thighs. Between the horns of the typical races of the present species and of *O. ammon* even the most superficial observer would not fail to easily recognise the difference. Those horns of *O. poli karelini* in which the outer front angle is rounded off are, however, much more like those of *O. ammon typica* in form, although the marked difference in stoutness and depth forms a ready distinction between them.

In the British Museum this species is represented by a magnificent series of skulls and horns from the Pamirs, and also by a mounted male and female in summer pelage presented by Mr. Littledale. All these belong to the Pamir race ; but the Thian Shan form is likewise represented by several mounted specimens of various ages obtained during the Second Yarkand Expedition under the leadership of the late Sir Douglas Forsyth. These latter are, however, all in the winter pelage, and it is thus, unfortunately, at present impossible to compare the two races at the same season, at least so far as the British Museum collection is concerned.

In the absence of the original specimens, it is difficult to say whether

the sheep called by Mr. Sclater *Ovis arkar* is the present species or *O. ammon*. On the one hand, *arkar* is the Turki name of *O. poli*, but, on the other, the skulls mentioned by Mr. Sclater were reported to have come from the Altai.

Distribution.—From the Thian Shan and the plateau north of Hunza through the Semirechinsk Altai and the Pamirs to the valley of the upper Amu Daria, or Oxus. By Prezewalski it has been recorded from the Altyn-tag, to the south of the Gobi, but this reference is very doubtful, and it is probable in that district its place is taken by a member of the *ammon* group. The definitely known distributional area is therefore situated on the western border of the hollow ellipse occupied by the *ammon* group, the typical and most highly specialised race inhabiting the extreme western portion of the area, and the less modified Thian Shan form occurring in the country between the Pamir race and the typical *O. ammon*.

History.—Although met with by Marco Polo during his Asiatic journeys, this sheep was first definitely made known to European science by skulls obtained by Lieutenant Wood, R.N., in 1838, on his return from his journey to the source of the Amu Daria, when detached from Sir Alexander Burne's Mission to the Court of Cabul. These specimens, one of which is preserved in the British Museum, and the other in the Royal College of Surgeons, were obtained on the high plateau near Lake Siri Kol, at an elevation of about 16,000 feet above the sea-level, and apparently from near the same locality as the one mentioned by Marco Polo. Two years after their discovery the species to which they belonged was named *O. poli* by Blyth. So far as I am aware, nothing more was known in England with regard to the species till the return of the Second Yarkand Expedition in 1874, when several skulls of the typical Pamir race, and also skins from the Thian Shan, then regarded as belonging to the same form, were brought home. Some of these skins were described by Dr. Stoliczka as the true

Ovis poli. It happened, however, that as far back as about the year 1840 the Russian explorer Karelin obtained some large wild sheep from the Alatau, near Semirechinsk and due north of Lake Issik Kul, which in 1873 were named in his honour *O. karelini* by his countryman Severtzoff. In 1875 Sir Victor and Mr. B. Brooke referred the specimens brought home by the Yarkand Expedition from the Thian Shan to *O. karelini*; and four years later this species was accepted by Mr. Blanford, in his account of the mammals of the expedition, as a valid one. Later on, however, the same writer, from the study of additional specimens, came to the conclusion that *O. karelini* was, at most, merely a variety of *O. poli*; and this view was subsequently adopted by Mr. W. L. Sclater, who wrote as follows: "The above, I think, is sufficient to justify the combination of the Pamir typical form and the Thian Shan specimens brought back by the Yarkand Expedition, under the name of *Ovis poli*, even if the sheep described by Severtzoff as *O. karelini* should turn out to really differ from the typical *O. poli* of the Pamir."

Habits.—Since the habits are fully described under the heading of the two races, it will suffice to state here that the typical *Ovis poli* is but rarely found at elevations below 10,000 and 11,000 feet above the sea, and sometimes at much higher levels; the Thian Shan race is, however, stated by Severtzoff to descend as low as 2000 or 3000 feet. It is essentially an inhabitant of open, hilly, grass-clad plains; and only takes to the mountains for the purpose of concealment, avoiding even then the more rocky and precipitous localities.

a. PAMIR RACE—*OVIS POLI TYPICA*

Characters.—Size large; horns of adult males of great length, with both the front angles usually well developed at the base, and the spiral, which may be either comparatively close or extremely open, forming

much more than a single complete circle. Frequently, although by no means invariably, the wrinkles on the outer lateral surface of the base of the horns are but slightly developed.

In the summer pelage the face of the male is pure white, and there is much white on the under-parts and flanks ; winter pelage of same practically indistinguishable from that of the Thian Shan race. Females in summer uniformly dark blackish-brown above, without a distinct median dorsal stripe, and still more white on the flanks and thighs.

Of this race the British Museum has a mounted male and female in



FIG. 38.—Marco Polo's Sheep Head.

the summer dress ; while the winter garb is well shown in Severtzoff's plate in the *Trans. Soc. Moscou* for 1873.

The following are some of the largest horn-measurements given by Mr. Rowland Ward ; the fifth in the list being an additional specimen, now in the collection of Sir E. G. Loder :—

Length along Front Curve.	Basal Circumference.	Tip to Tip.
75	16	$54\frac{1}{2}$
73	15	48
71	$15\frac{1}{2}$	$53\frac{1}{3}$
$69\frac{1}{2}$	$15\frac{1}{4}$	56

Length along Front Curve.	Basal Circumference.	Tip to Tip.
$69\frac{1}{2}$	$14\frac{1}{2}$	39
$68\frac{1}{2}$	15	$35\frac{3}{4}$
68	17	43
68	16	52
$67\frac{3}{8}$	16	53
67	$16\frac{1}{2}$	42
$66\frac{7}{8}$	$15\frac{5}{8}$	46
$66\frac{7}{8}$	$13\frac{7}{8}$	?
66	$15\frac{1}{4}$	44
$65\frac{1}{2}$	16	53
65	16	$44\frac{1}{2}$
65	$16\frac{1}{2}$	$49\frac{1}{2}$
65	?	?
$64\frac{1}{2}$	$16\frac{1}{2}$	46
$64\frac{1}{4}$	$16\frac{1}{2}$	41
$64\frac{1}{4}$	$15\frac{1}{4}$	39
$63\frac{5}{8}$	$16\frac{1}{8}$	$42\frac{1}{2}$
$63\frac{3}{8}$	$15\frac{3}{8}$	$46\frac{1}{4}$
$62\frac{3}{4}$	$16\frac{1}{4}$	51
62	$15\frac{1}{4}$	40

Distribution.—The Pamirs, from Hunza to near the sources of the Amu Daria.

Habits.—The following excellent account of the habits of Marco Polo's sheep on the Pamirs is given by Viscount E. de Poncins :—"As a rule, *Ovis poli* are not at all fond of difficult and rocky mountains. Their true ground is the long rolling plateau or the rounded hills of the Pamirs. I never saw one in a really bad place. They are not very wary, but often difficult to stalk on account of the ground. A close shot is a rare occurrence, and 200, 250, or 300 yards is the common range.

"They are commonly found at a height from 18,000 feet up to the snow, the little patches of grass along the snow lines over broad stony nullas being their favourite resorts. They feed in the early morning and keep moving about till ten or eleven o'clock in the day; then they lie

down, sometimes on the same spot, or oftener they go up some bare hill, where they scratch the ground and make a sort of big 'form.' I did not notice that they are at all fond of lying on the snow. I nearly always found them in very dry places or on the stony slopes. It is not easy to see them when they are moving about, and when standing they look very light coloured except on the back.

"When lying down arkars nearly always keep the head erect, as if on the lookout, and when sleeping they lie with the neck outstretched. I saw big males with heavy heads resting their horns on the ground. In this case the under-parts of the neck and jaw do not touch the earth by several inches. The animal cannot touch the ground except with its mouth, on account of the shape of the horns.

"They seem to be affected by height. I more than once saw them, when going at full speed uphill, open their mouths as if in want of breath. When going uphill they never run very fast, and stop from time to time. When going leisurely they do not mind heights over 17,000 feet. I saw some coming down for food on the sky-line at certainly more than 18,000 feet. When disturbed they go up slowly but steadily to great elevations. As a rule, they dislike snow and are very cautious when in deep new snow. I once saw four repeatedly try a glacier covered with new snow not more than 400 yards from me. It was wonderful the way in which they avoided the bad places. The one in front went very slowly, trying the ground, and every now and then went shoulder-deep into the snow. He then drew back and tried other places without success, and then saw me.

"After keeping very quiet all day, about three or four o'clock they go again to feed. Once I saw three males fighting on the way to the grazing-ground. They were butting each other exactly as sheep do, and sometimes ran alongside each other striking sideways against the ribs and flanks. The points of the horns being at right angles with the line of the neck, they must hurt each other in this way much more than

when knocking their heads together. When engaged in such a fight they utter a kind of low grunt, and the noise of the horns against each other can be heard a long way off. They do not move about at night except when disturbed.

“One has to be very cautious when watching *Ovis poli*, as they have excellent sight and are wonderfully keen-scented. If they see anything, they all stand looking at it, crowding against each other and striking the ground with the fore-feet, often coming some paces nearer. All at once one bounds away, all the herd follows, and before long all stop again and turn to look at what has disturbed them. Then they start again and stop again, sometimes every two or three hundred yards. . . . They nearly always resort to the same places and the same nullas. Big herds always consist of females and young males. When about five years old the males herd together in small parties of two or three, sometimes more, but scarcely ever exceeding eight or ten. Once only I saw twenty-three. These herds of males spend the summer in the highest and most remote nullas, but in winter they come lower down, and many die of starvation in the spring, when, after a bad winter, the food runs short. One can see on the ground many heads of old individuals which died in the spring. In some places they are to be seen by dozens, and by the more or less decayed condition of the horns and skulls one can guess how long they have been lying on the ground. During the summer there is not a single big male to be seen near those places where the horns are found, and it is evident that they only come in winter. . . . When galloping they have a peculiar way of keeping the head quite erect; this is certainly due to the great weight of the horns, which would be felt much more if the head were kept straight out. All the same, they go very fast indeed downhill, and their gallop is a long stride even when going uphill; but I noticed more than once what a peculiar stiff action they have in the shoulder, which is due to the way they carry their heads.”

The weight of a good ram's head is estimated by the Viscount at about 40 lbs.; and to support this enormous burden great strength of neck is requisite. This is effected by an excessive development of the great tendon of the neck, the ligamentum nuchæ of anatomists, which is like a cable. Some idea of the numbers in which these magnificent sheep are found on the Pamirs may be gathered from a statement of the same writer, to the effect that he estimated the number he saw during a single day's hunting at not less than 600 head. Such a profusion of large animals is only to be met with elsewhere in Africa, and formerly on the American prairies.

b. THIAN SHAN RACE—OVIS POLI KARELINI

(?) *Ovis sculptorum*, Blyth, *Proc. Zool. Soc.* 1840, p. 12; Flower and Garson, *Cat. Osteol. Mus. Coll. Surg.* pt. ii. p. 245 (1884).

Ovis karelini, Severtzoff, *Trans. Soc. Moscou*, vol. viii. art. 2, pp. 150 and 154, pl. i. (1873), *Ann. Mag. Nat. Hist.* ser. 4, vol. xviii. pp. 171, 210, and 217 (1876); Brooke, *Proc. Zool. Soc.* 1875, p. 512; Blanford, *Results of Yarkand Mission—Mamm.* p. 80 (1879).

(?) *Ovis collium*, Severtzoff, *Trans. Soc. Moscou*, vol. viii. art. 2, p. 154 (1873).

(?) *Ovis heinsii*, Severtzoff, *op. cit.* pp. 150 and 154 (1873); Brooke, *Proc. Zool. Soc.* 1875, p. 517; Prezewalski, *Cat. Zool. Coll.* p. 15 (1887).

Ovis poli, Stoliczka, *Proc. Zool. Soc.* 1874, p. 425, pl. liii.

Characters.—Distinguished from the typical race by the following characters:—Horns of adult male shorter, their spiral seldom much exceeding one complete circle; the outer front angle in some specimens completely rounded off at the base, but in other examples sharp. In the winter coat apparently rather less white on the buttocks and thighs, and the upper part of the face, at least frequently, brownish instead of pure white; female in winter coat (according to Dr. Stoliczka's figure) with a

dark stripe from the back of the head to the root of the tail. Height at shoulder ranging from 3 feet 6 inches to 3 feet 8 inches.

Ovis karelini was first described upon the evidence of specimens obtained from the Alatau, north of Lake Issik Kul in the Semirechinsk Altai, the translation of Severtzoff's original description running as follows: "The horns are moderately thick, with rather rounded edges; frontal surface very prominent; orbital surface rather flat, narrowing only in the last third of its length. The horns are three times as long as the skull. . . . The neck is covered by a white mane shaded with grayish-brown. The light brown of the back and sides is separated from the yellowish-white of the belly by a wide dark line. The light brown of the upper-parts gets gradually lighter towards the tail, where it becomes grayish-white, but does not form a sharply defined anal disk. On the back there is a sharply marked dark line running from the shoulders to the loins. I did not find any soft hair under the long winter hair in October. . . . Height at the shoulder 3 feet 6 inches; length of the horns from 44 to 45 inches."

This description obviously applies to animals in the winter coat.

In the continuation of his memoir Severtzoff states that the same sheep inhabits all the neighbourhood of Issik Kul, to the south of which it is met with, although not very commonly, on the northern flanks of the Thian Shan, which are more or less wooded. Now during the sojourn of the Second Yarkand Expedition at Kashgar numerous large sheep were brought in, which were in the winter dress and had been transported from the Thian Shan, apparently in a frozen condition. Although described by Dr. Stoliczka as the true *Ovis poli*, they were subsequently identified by Sir V. Brooke with the *O. karelini* of Severtzoff, and from the locality whence they came, and their general agreement with the description of the latter, there can be little hesitation in accepting the identification. Dr. Stoliczka's description of the coloration of the male is as follows: "General

colour above hoary brown, distinctly rufescent or fawn on the upper hind neck and above the shoulders, darker on the loins, with a dark line extending along the ridge of the tail to the tip. Head above and at the sides a grayish-brown, darkest on the hinder part, where the central hairs are from 4 to 5 inches long; while between the shoulders somewhat elongated hairs indicate a short mane. Middle of upper part of neck hoary white, generally tinged with fawn; sides of body and the upper part of the limbs shading from brown to white, the hairs becoming more and more tipped with the latter colour. Face, all the lower-parts, limbs, tail, and all the under-parts, extending well above towards the loins, more white. The hairs on the lower neck are very much lengthened, being from 5 to 6 inches long. Ears hoary brown externally, almost white internally."

Several of these specimens are now mounted in the British Museum; and all of them show more or less brown on the upper half of the face, while the dark line on the tail is not apparent. Otherwise they accord well with the description.

As already mentioned, it is most unfortunate that there are no means of comparing these specimens with the corresponding (winter) dress of the typical *poli*. But it seems most probable that at the same season the general coloration of the two forms would be very similar; and, apart from other features, it is thus unlikely that *karelini* would in summer assume the dark buttocks, thighs, and under-parts of *O. sairensis*. Still, as has been stated above, in the dark upper part of the face and the blackish dorsal stripe of the female the present form does lead on from the typical *poli* in the direction of the latter.

With regard to the horns, one of the Thian Shan males in the British Museum has the outer front angle completely rounded off, as is well shown in the figure given by Sir V. Brooke in the Zoological Society's *Proceedings* for 1875, p. 512, figs. 2 and 3. In the other examples, however, both front angles are very strongly marked indeed; and it does

not appear that this angulation can be attributed to immaturity, one of the specimens being taller than the animal in which the front edges of the horns are rounded off. This rounding of the horns cannot, therefore, be taken as an invariable point of distinction between *poli karelini*, and *poli typica*. Neither, I think, can inferiority of size in the former be so regarded, one of the specimens with angulated horns in the museum measuring 3 feet 8 inches at the shoulder, and thus considerably exceeding Mr. Littledale's mounted example of the Pamir race. And I think it most probable that in the Western Semirechinsk the two will be found to intergrade completely.

The *Ovis sculptorum* of Blyth is founded on a single horn in the Museum of the College of Surgeons which was regarded both by Severtzoff and Brooke as probably identical with the present form. And if such identity could be definitely established, Blyth's name, as the earlier, should be adopted. In the absence of any such certainty the name generally in use has been retained for the present.

Now comes the question as to *Ovis heinsi*, named on the evidence of skulls obtained from Tokmak, situated in the Southern Semirechinsk to the north-west of the Issik Kul lake and to the north-east of the Alexandrovski Mountains, and thus within what ought to be the range of the present species. And, so far as the available evidence goes, I cannot see how *O. heinsi* can be differentiated from the present race of *O. poli*, and, at any rate, that form cannot apparently be more than another race of the same species.

Distribution.—Typically from the Alatau, but apparently extending over the greater part of the Semirechinsk and Sapliski Altai to the Thian Shan and south-west to the Narin river, where its range is said to overlap that of *O. poli typica*. Tokmak and the Alexandrovski Mountains, the former of which is the typical locality for the so-called *Ovis heinsi*, are included in this area.

Habits.—The mode of life of the Thian Shan race is doubtless identical with that of the typical *O. poli*. Severtzoff writes as follows :—“ *Ovis karelini*, like other sheep, does not live exclusively amongst the rocks, as is the case with the different species of *Capra*. It is not satisfied, like the



FIG. 39.—A dead male of Marco Polo's Sheep. From a photograph by Mr. David T. Hanbury.

latter, with small tufts of grass growing in the clefts of rocks, but requires more extensive feeding-grounds ; it is therefore more easily driven from certain districts than is the case with *Capra*. In the neighbourhood of Kopal, for instance, the goats are abundant in the central parts of the steppes of Kara, whilst the sheep have been partially driven from these places, visiting them in autumn. On the southern ranges of the Semi-rechinsk Altai, in the vicinity of the river Ili, wherever good meadows

and rocky places are found, *Ovis karelini* occurs at elevations of from 2000 to 3000 feet ; at the sources of the rivers Lepsa, Sarkau, Kora, Karatala, and Koksa it goes as high as 10,000 feet, and even to 12,000 feet in the neighbourhood of the Upper Narin. In winter it is found at much lower elevations."

In the *Field* of 5th November 1898 Capt. R. B. Cobbold writes that owing to rinderpest, which has raged throughout the winter all over the Pamirs, *Ovis poli* "has, for the time being, become practically extinct. All over the Russian Pamirs, and in the Taghdumbash also, hundreds of dead animals may be seen ; and in nullas where last October I saw hundreds, in July last there were only skeletons. On the Taghdumbash the rinderpest has not been so severe as on the Russian side ; but large heads, owing to the numbers that have been shot by British sportsmen, are few and far between. The nullas in Chinese territory which hold *poli* are in the north, the nullas near the Karaart Pass at the head of the Kuntemis river ; but there is no head of 50 inches in any of them. Farther south in the Taghdumbash, the Kungerab, Oprang, Bayik, Kukturuk, and two nullas near Bozai Gumbaz, still hold a few small heads ; but I saw no head of 50 inches in any of them this summer. The big heads I killed last autumn, and which were lately mentioned in the *Field*, were killed in the neighbourhood of the Bayik Pass ; and at that time large males were numerous on the Russian and Chinese side of that pass, but they have literally died in hundreds."

INCERTÆ SEDIS

Ovis nigrimontana

Ovis nigrimontana, Severtzoff, *Trans. Soc. Moscou*, vol. viii. art. 2, p. 154 (1873) ; Brooke, *Proc. Zool. Soc.* 1875, p. 517 ; W. L. Sclater. *Cat. Mamm. Ind. Mus.* pt. ii. p. 132 (1891).

Description.—The translation of Severtzoff's original description is as follows :—"The horns are not massive ; the fronto-nuchal edge is very sharp, the other two edges are also not much rounded ; the frontal surface is narrow, but prominent ; the other two surfaces pressed in, rendering the edges sharp, especially the fronto-nuchal edge. A section of the base of the horn shows the orbital and nuchal surfaces to be nearly equal in width, each of them being about $1\frac{1}{2}$ times as wide as the frontal surface. . . . The ridges of the horn are sharp, straight, and regularly parallel with each other. . . . This species is, like *Ovis heinsi*, only known from skulls ; amongst these is one of an adult male. Through a telescope I saw that the colour of the animal is a light grayish-brown, with a white belly and rump. It is considerably smaller than *Ovis karelini*, being one of the smallest and weakest of all the Central Asiatic sheep." The length of the horns in the type skull is given as 38 inches.

Bearing in mind the known variability in the horns of these large sheep, the above description does not appear sufficient to define this form, and there are no specimens in the British Museum from the typical locality. Mr. W. L. Sclater is, however, probably right in his suggestion that *O. nigrimontana* conforms to the *ammon* type, of which it may constitute a small race, its distributional area being on the western border of that of the latter species. If it be true that this sheep has a white caudal disk and under-parts, it seems, as already mentioned, unlikely that it can be the same animal as Littledale's sheep.

Distribution.—The Karatau, or Black Mountains, lying to the southwest of Kulja on the Mongolian frontier.

Ovis darwini

Ovis darwini, Prezewalski, *Cat. Zool. Coll.* p. 15 (1887).

The brief description of this sheep being in Russian, I can say nothing either as to its characteristics or its habitat.

8. THE BIGHORN—*Ovis CANADENSIS*

Ovis canadensis, Shaw, *Naturalist's Miscellany*, vol. xv. p. 610 (about 1804);¹ Biddulph, *Proc. Zool. Soc.* 1885, p. 684; Ward, *Records of Big Game*, p. 246 (1896).

Ovis montana, Cuvier, *Règne Animal*, vol. i. p. 267 (1817), *nec* Ord, 1815; Desmarest, *Mammalogie*, vol. ii. p. 487 (1822); Richardson, *Fauna Bor.-Amer.* p. 271 (1829); Blyth, *Proc. Zool. Soc.* 1840, p. 77; Gray, *List*



FIG. 40.—Head of Rocky Mountain Bighorn. (Rowland Ward, *Records of Big Game*.)

Mamm. Brit. Mus. p. 169 (1843); Baird, *N. Amer. Mamm.* p. 674 (1857); Blasius, *Säugeth. Deutschlands*, p. 470 (1857); Guillemard, *Proc. Zool. Soc.* 1885, p. 677.

Ovis cervina, Desmarest, *Nouv. Dict. Hist. Nat.* vol. xxi. p. 551 (1818); Alston, *Biol. Centr.-Amer.—Mamm.* p. 111 (1880); Rhoads, *Amer. Natural.* vol. xxviii. p. 526 (1894); Matschie, *SB. Ges. naturfor. Berlin*, 1896, p. 99.

¹ See Biddulph, *tom. cit.* p. 682. On account of the absence of a date to the volume in which it occurs, Mr. Rhoads rejects the name *canadensis* in favour of *cervina*, but it is definitely known that the volume in question appeared before 1813.

Ovis pygargus, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 318, v. p. 359 (1827).

Ovis californianus, Douglas, *Zool. Journ.* vol. iv. p. 332 (1829).

Ovis californiana, Blyth, *Proc. Zool. Soc.* 1840, p. 77.

Ovis (Argali) montana, Gray, *Knowsley Menagerie*, p. 37 (1850).

Caprovis (Argali) canadensis, Gray, *Cat. Ungulata Brit. Mus.* p. 176 (1852), *Cat. Ruminants Brit. Mus.* p. 57 (1872).

Musimon montanus, Gervais, *Hist. Nat. Mamm.* vol. ii. p. 191 (1855).

Caprovis canadensis, Gray, *Hand-list Ruminants Brit. Mus.* p. 133 (1873).

Plates XVII. and XVIIIA.

Characters.—Size comparatively large, the height at the shoulder varying from about 3 feet 2 inches to 3 feet 6 inches in the larger races. Face-glands very small, and the pits in the skull for their reception correspondingly reduced in size. Horns of adult male markedly triangular, with the transverse wrinkles much less developed and the longitudinal striæ distinctly more apparent than in any of the species hitherto mentioned; the outer front angle markedly prominent, but the inner one partially rounded off; the curvature forming a more or less close spiral, but little if at all exceeding one complete circle. General colour of upper-parts varying from white or pale tawny to dark grayish-brown, frequently with a darker streak along the middle line of the back; a white disk of variable size on the buttocks, which is always divided in the middle line by a dark streak connecting the brown of the back with the dark upper surface of the tail; flanks and front surfaces of the legs darker than the back; more or less of the under-parts, as well as a considerable portion or the whole of the posterior surfaces of the legs, together with a variable proportion of their inner sides, white; outer aspect of thighs always dark coloured like the back.

From all the large sheep described above, the bighorn, with its various races, is easily distinguishable at a glance by its much smoother horns, and by the more or less conspicuous caudal disk being divided by the dark line running from the brown of the back to the tail; the white markings on the legs are also very characteristic. A closer examination will reveal the minute and almost rudimentary condition of the glands below the eyes and the depressions of the skull in which they are contained. All the above features indicate an approximation from the argali type in the direction of the bharal and the goats.

Much still remains to be done in working out the various modifications of the bighorn type, as the specimens in the British Museum are quite insufficient to permit of this being accomplished at present. Although there are several more or less distinct and definable forms of bighorn inhabiting the North American continent, all these appear best regarded, quite irrespective of whether or no they intergrade, as geographical modifications of a single well-marked specific type. Another bighorn is met with in Kamschatka and other districts of North-Eastern Asia, and although this animal is markedly distinct from the typical bighorn of the Rocky Mountains, yet the wild sheep from Alaska and other districts in the north-west of the American continent show such a marked approximation in the characters of their horns, as well as in certain other features, to the Asiatic bighorn, that it seems preferable to include the latter within the limits of the same species. It must, however, be understood that there is no evidence of gradation between the Alaskan and Kamschatkan bighorns, and that the latter, as might have been expected, is more distinct from all the American forms than these are from one another. Additional information is urgently required with regard to the white bighorns, of which specimens have been received both from Alaska and Kamschatka, as it is not yet determined whether the white coat is merely a seasonal phase. Turning to nomenclatural considerations, the reasons

for retaining the name *canadensis* instead of *cervina* have already been stated. Reference must, however, be made to the case of the name *O. californiana* which is somewhat peculiar. By its founder Douglas it was applied to the wild sheep ranging from British Columbia to California, but said to be most abundant in the latter area. The type was, however, a skull and skin from British Columbia; the skull being now in the British Museum. The tail was described as being long. Blyth's description was merely an amplification of the original one, but he gave the habitat as California. Manifestly, however, the typical locality must be British Columbia; and the name *california* would obviously be inappropriate to a sheep coming from that region. Accordingly, the name cannot be adopted for either of the races into which the species has been divided by later writers.

Distribution.—Typically from the western and north-western districts of North America, but also ranging into the countries bordering the northern part of the Sea of Okhotsk and parts of North Siberia. In America the bighorn and its various races have a very extensive range. They are found throughout the whole extent of the Rocky Mountains, both on their eastern and western slopes, and extend as far south as Sonora, Northern Mexico, and the southern extremity of the Californian peninsula, so that on the Pacific coast they occur on all the lesser mountain chains from British Columbia to California. Northwards they extend throughout Alaska to the shores of Bering Sea and the Arctic Ocean. Their distribution in the Eastern Hemisphere is noticed later on, but it may be mentioned that they probably occur on the Asiatic coast of Bering Strait, so that the American and Asiatic forms are separated by a comparatively small distance.

The habits of bighorn may be more conveniently referred to under the heading of the various races.

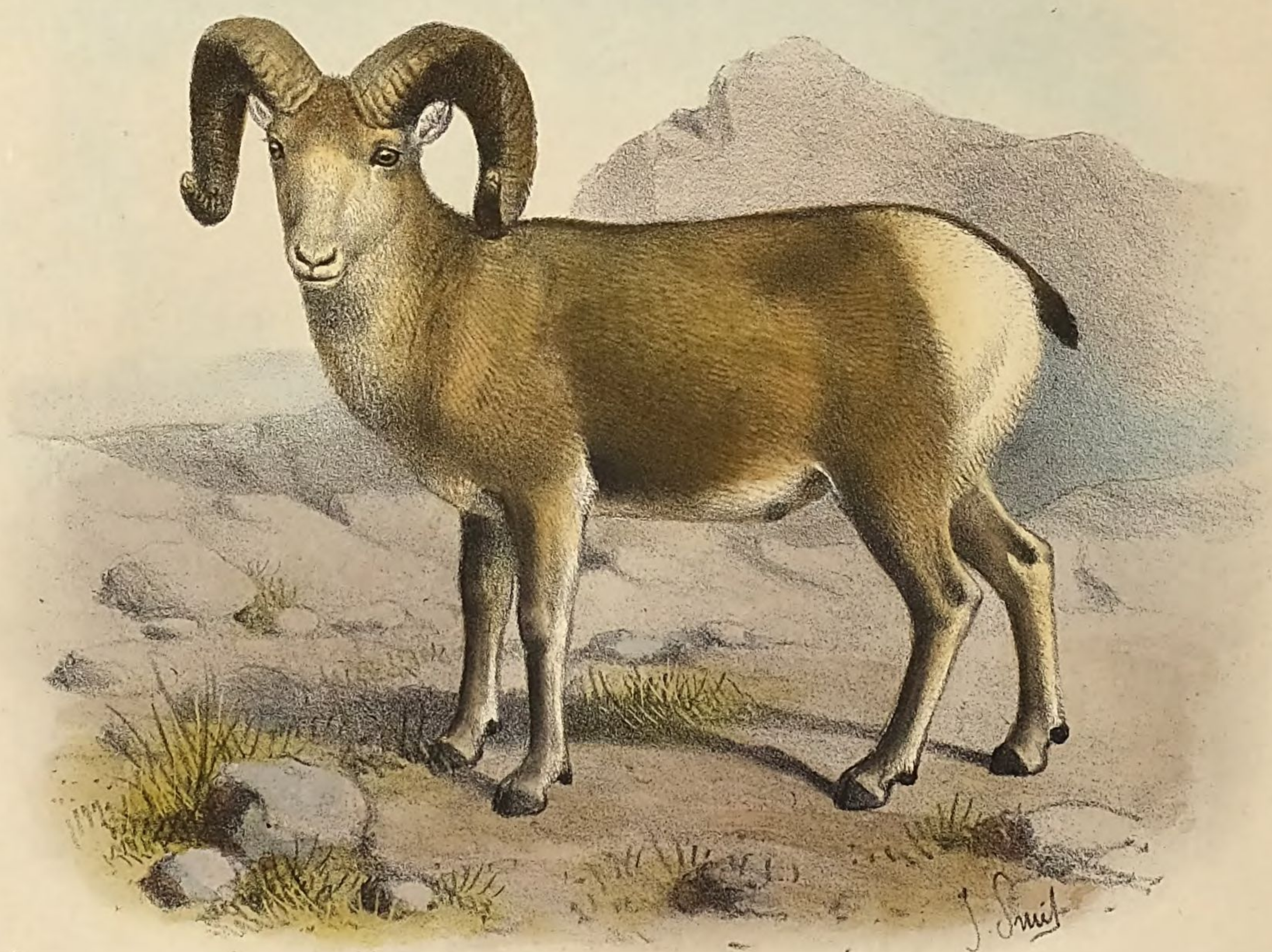
a. SOUTHERN RACE—*Ovis canadensis nelsoni*

Ovis nelsoni, Merriam, *Proc. Soc. Washington*, vol. xi. p. 218 (1897).

Characters.—Somewhat inferior in size to the typical, or Rocky Mountain race, and much paler in colour, with the molar teeth decidedly smaller. The general plan of coloration is stated to be very much the same as in *O. canadensis stonei*, but the pallor is even more marked when compared with that form. The light caudal disk is small and completely divided in the middle by a dark line; the tail is relatively short and slender; and the cheek-teeth are unusually small. General colour of upper-parts, except the caudal disk, pale dingy brown; under-parts much darker, and contrasting strongly with the white areas; abdominal region, together with a streak in the middle line, continued forwards nearly to the fore-legs, inner side of thighs, and hinder surface of legs white.

Dr. Merriam remarks that, compared with the north-western race, "The contrast in colour is even more marked, but the pattern seems to be the same, and the darkening of the under-parts is also a character of *stonei*." No mention is made in the original description of the size and shape of the horns, but from Mexican specimens that have come under my notice these seem to be generally similar to those of *stonei*.

Distribution.—Typically the Grapevine Mountains, on the boundary between California and Nevada, a little south of 37° N. latitude, probably also including the semi-barren desert ranges of Mexico and the Southern United States, from Texas to California.



ROCKY MOUNTAIN BIGHORN.

*b. ROCKY MOUNTAIN RACE—OVIS CANADENSIS TYPICA**Plate XVII.*

Characters.—Size large, the height at the shoulder apparently ranging from about 3 feet 2 inches to 3 feet 6 inches.¹ Skull long and narrow. Horns of adult male (fig. 40) very massive and thick, without a distinct keel on the outer front edge, and with the spiral short, so that the tips, which are generally blunt and broken, are directed nearly forwards. Ears broad, pointed, deer-like, and moderately clothed with hair, being apparently a trifle larger than in the argalis. No long mane on the back of the head and nape of neck. Caudal disk large and continued on each side of the dark streak connecting the back with the tail well on to the upper surface of the hind-quarters. General colour of upper-parts some shade of grayish-brown, darkening along the middle line of the back, where there is a more or less distinct dark streak; in winter and spring the prevalent tinge more decidedly brown, and in autumn more distinctly gray; old males, at least in the summer coat, very pale coloured, so that the caudal disk is scarcely distinguishable from the darker area. The under-parts, the inner and hinder surfaces of the legs, the buttocks and a streak on each side of the base of the tail, the chin and muzzle, and a spot on a grayish ground near the upper part of the throat white or whitish; face and outer surface of ears light ashy-gray; front surfaces of legs a darker blackish gray-brown than the back, and the upper surface of the tail lighter than the dorsal streak. Light area on under-parts not sharply defined.

Such is the best description I am at present able to give of the coloration

¹ Mr. Cameron informs me that adult rams measure from 40 to 42 inches in height at the withers, and in girth around chest behind shoulders from 46 to 49 inches. They weigh from 150 to 300 lbs. clean, according to season, as when much "run" they would appear to lose about a fourth of their weight; some of the ewes at this time weighing as much as the five-year old rams.

of the typical race of this species, the British Museum being singularly deficient in examples. Indeed, almost the only good skin it possesses is that of an old male, which is mounted and exhibited. It is apparently in the winter coat, judging from the length and thickness of the hair, and remarkable for its extreme paleness, but whether this is normal or due to fading, I am unable to say.

Mr. E. S. Cameron informs me that in autumn and winter the prevailing tint is the same as that of the mule-deer, namely, a dark brownish-gray, and when the two animals are placed side by side no difference can be perceived in the colour of the upper-parts. In the sheep the under-parts anteriorly, portions of the legs, and the tail, are brown; a narrow strip of the brown colour of the tail being continued across the white of the rump and meeting the gray of the back. The tail itself is very short, only 4 inches in the largest rams, surrounded by an extensive patch of yellowish-white extending between the thighs and to the groin. Measured from the root of the tail this disk reaches $8\frac{1}{2}$ inches above and $8\frac{1}{2}$ inches on either side in full-grown examples, and is thus very conspicuous in the bad-lands where these sheep show up like a band of pronghorns—more especially in early summer. The muzzle is of the same yellowish-white colour. A broad yellowish-white stripe extends down the inside of the fore-legs and on the outside of the hind-legs; or, in other words, the legs are half-white and half-brown; but I have seen old rams in which this white was much circumscribed. In the spring the sheep gradually bleach out lighter and appear of a dun colour until they shed the coat, which may be any time from the end of May to the middle of July according to the season.

The following are some of the largest horn-measurements of the present and other American races recorded by Mr. Rowland Ward :—

Rocky Mountain Bighorn

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Length along Front Curve.	Basal Circumference.	Tip to Tip.	Locality.
45	?	?	?
$42\frac{1}{2}$	$16\frac{1}{4}$	$25\frac{3}{4}$	Lower California
42	16	?	Wyoming
?	$17\frac{1}{4}$	?	"
$40\frac{3}{4}$	$16\frac{1}{2}$	?	Yellowstone
40	$15\frac{1}{4}$	?	Rocky Mountains
$40\frac{1}{4}$	$15\frac{1}{4}$	$20\frac{1}{4}$	?
$39\frac{5}{8}$	$15\frac{3}{8}$	?	Colorado
$39\frac{1}{2}$	$16\frac{1}{2}$	$24\frac{3}{4}$	Montana
$39\frac{1}{2}$	$15\frac{1}{2}$	19	?
39	$15\frac{3}{4}$	?	?
39	$14\frac{1}{8}$	$18\frac{1}{2}$	Rocky Mountains
$38\frac{3}{8}$	$15\frac{1}{2}$	22	?
$38\frac{1}{4}$	$15\frac{1}{4}$	$19\frac{1}{4}$	Montana
$38\frac{1}{4}$	$16\frac{3}{8}$	?	Bighorn Mountains
38	17	?	North-West Territory
38	15	?	British Columbia
$37\frac{3}{4}$	$15\frac{7}{8}$	$23\frac{3}{8}$	Mexico
$37\frac{3}{4}$	$16\frac{1}{4}$	$22\frac{1}{2}$	British Columbia
$37\frac{1}{4}$	15	16	"
37	16	31	Wyoming
37	$16\frac{1}{4}$	?	Montana
$36\frac{3}{4}$	19	15	British Columbia
$36\frac{3}{4}$	$15\frac{1}{4}$	$22\frac{1}{2}$	Wyoming
$36\frac{1}{2}$	$14\frac{1}{2}$	?	"
$36\frac{1}{2}$	$14\frac{1}{2}$	?	?
$36\frac{1}{2}$	14	...	Wyoming

Female horns seldom measure more than 15 inches along the curve. Mr. Ward says that "large horns of the male are now very difficult to obtain, and I have seldom of late years seen fresh-killed specimens whose horns exceed 38 inches on the curve from base to tip. American sportsmen are very keen to obtain horns of large circumference, and, as will be seen from the records here given, they very seldom exceed 16 inches."

Distribution.—Not definitely defined, but embracing the mountainous

districts of western North America from the desert regions of the Colorado river and Arizona northwards into British Columbia, where the present race not improbably intergrades with the next. Examples from the Yellowstone river, like the mounted ram in the British Museum, have somewhat less massive horns than those from Wyoming and Colorado, but in other respects appear to be indistinguishable.

Habits.—It is the custom of American sportsmen to speak of the Rocky Mountain bighorn as inhabiting the most inaccessible precipitous cliffs, thus giving the idea that in its mode of life it is more like a goat than the wild sheep of the Old World. According, however, to Mr. Phillips-Wolley, in his account of this animal published in the *Badminton Library*, this is quite a mistaken notion. Bighorn, he observes, are undoubtedly sometimes found in difficult and even dangerous places, but to describe sheep-shooting as anything like chamois or ibex-hunting is a mistake. In this respect, therefore, the bighorn does not depart so widely from the habits of other wild sheep as might easily be imagined to be the case from the accounts given by many writers.

For the following notes I am indebted to Mr. E. S. Cameron :—Bighorn are found in the “bad-lands” of the Yellowstone, Missouri, and Powder valleys, and are met with in flocks of from five to fifty individuals; they are very gregarious, and in my experience under no circumstances ever remain alone for long. The flocks, when undisturbed, seek the prairie to feed at daylight, returning to the bad-lands at nine or ten o’clock to rest until the afternoon, when they will again rise to feed among the bad-lands, often returning to the prairie in the evening, and grazing until dark. So far as I am aware, they never feed at night like the mule-deer. Their food consists of grass and three varieties of sage-plant, known locally as sweet sage, sour sage, and salt sage, but I have never known them to eat any wild fruits or berries such as are sought by the deer. Like these, they obtain their food in winter by scraping away the snow, and in summer they graze like

the domestic merinos, with which they sometimes associate on the prairie. I do not think that they can be reared in captivity without some kind of wild sage. They resemble mule-deer in frequenting a certain range of bad-lands, and always watering at the same spring, but are more shy, deserting the locality at the first alarm. In time of security the flock is led by an old ram, but when danger threatens he becomes a rearguard, and a ewe assumes the lead. This ram (excepting during the pairing season) would appear to be the usual sentinel, as he may be seen on the top of a high butte, while all the rest of the flock are hidden in gulches below—but no demoralisation occurs if the leader is killed, another sheep taking the initiative, and the flock quickly vanishing.

About the second week in November the old rams fight savagely for the ewes ; but the young rams pair earlier, and I shot a five-year-old which had collected some ewes on 29th October. The victors collect and herd as many ewes as they can, from five to a dozen being a usual number with one ram, while the disappointed males wander about alone ; but the possessor of ewes may lose them at any time, solitary rams being always on the lookout to give battle. The yearling and two-year-old rams remain with the ewes ; and although occasionally chased away by him, in the main the leader pays but little attention to them.

When the pairing season is over the sheep of all ages and both sexes flock together again until May, when the ewes drop out singly from the main body to bring forth their lambs. At this time large flocks of rams may be seen, locally called "buck herds" ; twenty-three of all ages, from yearlings upwards, having been counted in the bad-lands opposite Terry. The ewes generally have a single lamb at a birth, although rarely they are followed by twins. The dam carefully conceals the newly-born lamb amidst sage-brush or weeds in the bad-lands, from which she never goes any considerable distance. In three or four days the lamb, which resembles the parents in colour, comes out of its concealment to follow the ewe, and

about a week after the latter rejoins the flock. The six-months-old lambs constantly lose themselves, to wander about in a bewildered state. The ewe is a devoted mother, and although by nature these sheep are exceedingly timid, should her offspring be injured she will not desert it. On the other hand, an old ram severely wounded in a place from which he cannot leap, seems mad with rage and fear, as, with hair turned the wrong way, he charges desperately when closely approached.

A lamb makes a charming pet, and a male which was brought up in Miles City used to run about the cantonment; and so superior were its leaping powers, that when chased by dogs, or otherwise alarmed, it gracefully bounded on to the roofs of the houses, which consisted of one story. Remarkable as are the leaping powers of these sheep, the facility with which they walk up a sheer cliff seems even more remarkable. They will walk a little way in a zigzag manner to stop and look, then advance a little farther and again stop to reconnoitre on a face of rock steep enough to appal a cat, until they finally disappear over the top. This they are able to do by the structure of their feet, the exterior and interior line of each hoof being perfectly straight, while the toes are bevelled on the inside in such a way, that each division of the hoof catches in the soft rock like the blade of a pair of shears. In consequence of this, they make a square track, which can never be mistaken for that of deer or prongbuck, even by an unpractised eye.

Bighorn possess a strong scent, readily perceptible to human nostrils if they are in any numbers and the wind favourable. Horses quickly smell them, and my horse once stopped, refusing to proceed along the "divide" on which I was riding. Expecting some fierce beast, I crawled to the edge, only to discover a solitary ewe. Another horse, accustomed to carry deer, became frenzied when two sheep were packed on him. Although they never stay in them, sheep have no objection to passing through woods. I occupied a ranch at the foot of the Bighorn Mountains, to which they

were known to descend in winter, threading the dense forest of the mountain slope, and in this locality they constantly traverse the pine and cedar thickets. They will also frequent isolated buttes on the prairie, from which they must cover a long distance to reach the bad-lands, and in such situations they have often been pursued by horsemen. In these chases the rams outstripped the ewes. I have shot them on level ground, on which, in my opinion, they can run as fast as mule-deer ; but they offer an easier mark for the rifle than either deer or prongbuck, having neither the bounding gait of the former nor the incredible swiftness of the latter. I have seen a whole flock lie down at once in the bad-lands, but this is not a favourable time to creep up, as many are on the ledges of high buttes commanding the entire country, except to windward. Rather when they are feeding over ridges, and moving incessantly, can the coveted chance be obtained. As may be inferred from the above, these sheep are not so rare as generally supposed, and in out-of-the-way places they may still be seen in considerable numbers.

In November 1895, on the bad-lands above the Missouri river, Montana, I saw a larger flock than I had imagined could be found in this region. Signs of their presence had been noticed, when a large flock moved slowly over a small ridge about 300 yards distant, and passed out of sight, being immediately followed by a procession of twenty-five others in single file, among which were some enormous rams. As the first division was densely massed, they could not be counted, but there must have been at least fifty individuals in the entire flock.

c. LIARD RIVER RACE—*Ovis canadensis liardensis*

Characters.—Stature about equal to that of the Rocky Mountain race. Horns of adult male slender, with a sharp keel on the outer front edge, and their tips pointed, entire, and directed largely outwards. Ears small, short,

and bluntly pointed. In winter a thick mane of long hairs on the crown of the head and nape of neck. At this season the face and sides of the head dirty white, forming a marked contrast with the dark of the upper-parts of the body ; the mane grayish-brown ; hair of rest of neck mingled gray and



FIG. 41.—Liard River Bighorn. From the type male in the British Museum.

brown, gradually passing into the dark brown of the body ; no distinct dorsal streak ; caudal disk very large and pure white, with a narrow dark line crossing it to join the dark tail ; a darker streak on the flanks, below which the under-parts are pure white and sharply defined from the dark area ; front and part of sides of legs very dark blackish-brown, and the remainder white.

This race is typified by an adult mounted male from the Liard river in the British Museum, partially described by Col. J. Biddulph on pp. 679 and 680 of the *Proceedings* of the Zoological Society for 1885. It is in the winter pelage, and appears to be nearly allied to the north-western race, but is as large as the typical representative of the species. Unfortunately the north-western race is described from specimens believed to be in the summer pelage, and it is therefore by no means improbable that in winter they might develop a similar mane, and display equal lightness in the colour of the face as compared with that of the body. Even, however, if such were the case, the present form would apparently be differentiated by its larger size, and since it inhabits an area lying between that of *typica* and *stonei*, it may at least provisionally be allowed to rank as a separate race.

Distribution.—Typically the neighbourhood of Liard river, near the northern extremity of the Rocky Mountains, in about latitude 59° N.

d. NORTH-WESTERN RACE—*Ovis canadensis stonei*

Ovis stonei, J. A. Allen, *Bull. Amer. Mus.* vol. ix. p. 111, pls. ii. and iii. (1897); Nelson, *Nat. Geographic Mag.* vol. ix. p. 128 (1898).

Characters.—The original description of the adult male, apparently in the summer pelage, runs as follows:—"Above gray, formed by an intimate mixture of whitish and blackish-brown; face, ears, and sides of neck lighter and more whitish, being much less varied with blackish-brown; whole posterior area and lower-parts from hinder part of back downward and forward, including the posterior aspect of thighs, and the abdomen, white, the white area narrowing anteriorly and terminating in a V-shaped point on the middle of the chest; also a broad sharply-defined band of white on the posterior surface of both fore- and hind-limbs, extending from the body to the hoofs, and above including also the inner surface; front of neck, from base of lower jaw posteriorly to the white

of the ventral surface, including the breast and greater part of the chest, and thence along the sides to the thighs, nearly black; the lateral extension along the flanks becomes narrower posteriorly, and the neck is somewhat grizzled with white; outer surface of both fore- and hind-limbs blackish-brown, either uniform or in some specimens varied with a slight mixture of whitish; back of head with a broad area of black, narrowing posteriorly and continued to the tail as a well-defined dorsal stripe; tail wholly deep black, except a few white hairs on the middle of its lower surface; a narrow blackish chin-bar, varying in breadth and distinctness in different individuals; hoofs black; horns light brown."

In its relatively small size this sheep agrees with the Alaskan race, as it does in the form of its horns. It differs in that its prevailing coloration is either dark gray or blackish-brown, according to the area in question, instead of being a nearly uniform dirty white colour. With the typical race it agrees in a general way as regards its pattern of coloration, but the umber or wood-brown of the former is everywhere replaced in the present animal by blackish-brown, or black. The stature in the present race is, moreover, considerably inferior, and the horns are less massive, with a more outward curvature at the tips.

Distribution.—The upper part of the Stikin Valley, British North-West Territory, near the Alaskan frontier, at an elevation of between 6000 and 7000 feet above sea-level, and about 250 miles south of the area known to be inhabited by the Alaskan race.

Mr. Stone, the discoverer of this apparently well-marked race of bighorn, writes as follows to Dr. Allen, its describer:—"The only specimens of this sheep I had the opportunity of discovering were the males which I found during the months of August and September in the most rugged parts of the mountains, entirely above the timber-line. I often found them singly, and at no time did I discover more than five in one bunch, though one of my party reported having seen eleven together.

I saw perhaps fifty head, and secured twelve specimens. I was very careful in my study of these interesting animals, and I found them to be uniformly marked, both in colour and general characteristics.

“The youngest of the three now in the museum was secured August 8th 1896, in a very deep and rocky cañon, just at the base of one of the highest peaks in this part of the mountains. At the time I discovered him he was all alone, carefully making his way down the cañon, and from what I afterwards learned I am very much inclined to believe he was then in quest of the ewes, lambs, and yearlings in the edge of the timber farther down the mountain side, and it is quite likely that he had not yet regularly taken up the company of the older rams. The two older specimens were taken on August 10th, about five miles distant from the first, and were the only ones in the bunch. I watched them an entire afternoon before killing them. They passed the time alternately nibbling at tiny bits of grass occasionally seen peeping from crevices in the rocks, and playing or lying down on patches of snow and ice. They were very fat. Specimens taken two months later possessed the same markings.”

e. ALASKAN RACE—*Ovis canadensis dalli*

Ovis montana dalli, Nelson, *Proc. U.S. Mus.* vol. vii. p. 13 (1884).

Ovis dalli, J. A. Allen, *Bull. Amer. Mus.* vol. ix. p. 112 (1897); Merriam, *Proc. Soc. Washington*, vol. xi. p. 217 (1897); Nelson, *Nat. Geographic Mag.* vol. ix. p. 128 (1898).

Characters.—Stature not ascertained. Ears short and thickly haired. Horns of adult male apparently generally similar to these of the Liard river and North-Western races. In summer the coloration nearly uniform dirty white, so that the caudal disk is invisible; the dinginess of the white over the entire body and limbs being apparently due to the tips of the

hairs being dull rusty, thus making the fur look as though it had been slightly singed. In winter pure white.

Distribution.—Typically from the Upper Yukon Valley, Alaska, near where it crosses the British boundary, and extending as far north as about latitude 70° . The following passage occurs in Mr. Nelson's original description :—"From Mr. M'Questen, and various other fur-traders along the Yukon and elsewhere, I learned that the range of this form covers nearly all the mainland of Alaska where there are mountains, excepting the vicinity of the Bering Sea coast. It is limited strictly to the mainland, and occurs only among the higher parts of the mountains south of about 68° of latitude, but north of this it is found on lower ground, and as the mountains give place to low hills and rolling plains near the Arctic coast, it descends nearly or quite to the sea-level.

"Among the natives I have seen typical skins from the mountains south of the Upper Kuskokwim river; from the headwaters of the Tanana; from the Kadiak Peninsula near Bering Strait; also from the mountains east and north-east of Kotzebue Sound, and, during the summer of 1881, while cruising between Kotzebue Sound and Point Barrow, we saw hundreds of skins among the Eskimos, who invariably pointed to the low range of mountains a few miles back from the coast, when asked where the sheep were found.

"While hunting near Cape Thompson, on the Arctic coast, in the middle of July 1881, I saw a pair of these animals within about five miles of the coast, at an elevation of not over 300 feet above the sea. They were feeding on an open grassy plain at the foot of a series of low hills, over which they ran the moment they caught wind of me, as I tried to approach along the bed of a small gully."

In a later paper Mr. Nelson writes as follows concerning this sheep :—"Two species of mountain sheep, quite different from one another and from the Rocky Mountain bighorn, are known in North-Western America.



KAMSCHATKAN BIGHORN.

The first of these, a superb snow-white animal, was described by the writer some years ago as *Ovis dalli* in honour of Prof. W. H. Dall, the pioneer scientific explorer on the Yukon. The specimens upon which my description was based were obtained from the Fort Reliance country by Mr. L. N. McQuesten. Dall's mountain sheep is found over a wide area, from the low hills beyond the tree limit near the Arctic coast south across the Yukon and Kuskoquim to the Alaskan range."

From this it would appear at first sight that the animal is pure white at all seasons, but the original description shows that this is not the case; and a mounted specimen in bad condition in the British Museum has traces of pale tawny on the neck and fore-limbs. Hence it would seem probable that the pure white is assumed only in winter, and not always then, since the British Museum example is apparently in the winter coat. Mr. Walter Rothschild has a pure white head from Alaska in the Museum at Tring Park.

f. KAMSCHATKAN RACE—*OVIS CANADENSIS NIVICOLA*

Ovis nivicola, Eschscholtz, *Zool. Atlas*, p. i. pl. i. (1829); Brooke, *Proc. Zool. Soc.* 1875, p. 521; Guillemard, *ibid.* 1885, p. 675; Biddulph, *ibid.* p. 679; Tscherski, *Mém. Acad. St. Pétersbourg*, vol. xl. art. 1, p. 187 (1891); Ward, *Records of Big Game*, p. 249 (1896).

Ovis montanus, Middendorff, *Reise Zool.* p. 116 (1851), *nec* Cuvier, 1817.

(?) *Ovis borealis*, Severtzoff, *Trans. Soc. Moscou*, vol. viii. p. 153 (1873); Peters, *Monatsberichte Akad. Berlin*, 1876, p. 180; Bunge and Toll, *Exped. Neusibir. Inseln und Fena-Lande*, p. 34 (1886); Nehring, *Tundren und Steppen*, p. 36 (1890).

Plate XVIII.

Characters.—Size large, the height at the shoulder reaching to about 3 feet 2 inches. Ears very small, abruptly truncated, and very thickly haired; no distinct mane on the nape of the neck; hair much longer and finer than in either of the foregoing races; and the white caudal disk unusually small and not extending on to the upper surface of the hind-

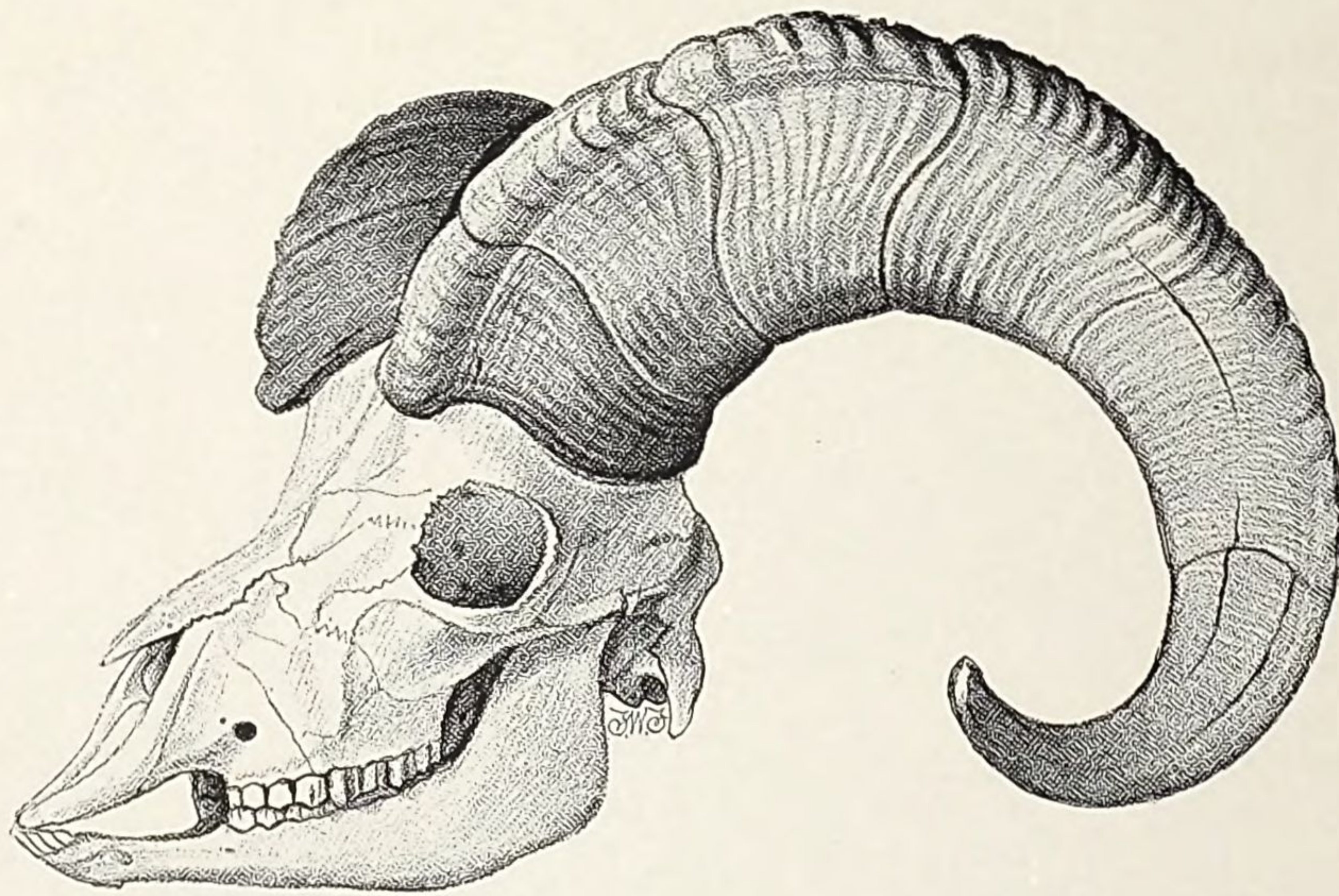


FIG. 42.—Skull and horns of Kamschatkan Bighorn. (Rowland Ward, *Records of Big Game.*)

quarters. Skull very short and broad, with the orbits much more prominent than in the Rocky Mountain race, and the pits below them almost obsolete. Horns of adult male generally similar to those of the Liard river and Alaskan races, being slender, very smooth, with a distinct keel on the front outer angle, and the spiral comparatively open, so that the tips, which are generally sharp and entire, are directed largely outwards. General colour of upper-parts (both in summer and autumn) grizzled grayish-brown, becoming more distinctly gray on the head and neck than elsewhere; an ill-defined patch on the forehead below the eyes, and the front of the legs rich uniform dark brown, as is the very broad stripe

extending from the dark of the back through the caudal disk to the tail ; upper and under lip grayish-white ; caudal disk, middle of under-parts, and a narrow line down the hinder surface of each leg white, there being also some white on the lower part of the inner surface of the metatarsal segment of the hind-legs. The white on the under-parts and posterior surface of the legs is fairly well defined from the adjacent brown areas, but not so sharply as in *liardensis*, the amount of white on the limbs being much less than in the two preceding races. In winter apparently turning white, either in some districts or invariably. A full-grown ram in good condition will weigh about 330 lbs.

The following dimensions of horns of this race are given by Mr. Rowland Ward :—

Length along Front Curve.	Basal Circumference.	Tip to Tip.
38	$13\frac{1}{2}$	26
$35\frac{1}{2}$	14	$26\frac{1}{2}$
$34\frac{1}{2}$	$11\frac{7}{8}$	$17\frac{3}{4}$
34	$13\frac{1}{2}$	$23\frac{5}{8}$
$32\frac{3}{4}$	$13\frac{1}{2}$	23
$31\frac{1}{2}$	14	26
$31\frac{1}{2}$	$13\frac{5}{8}$	21
$31\frac{1}{2}$	$13\frac{3}{4}$	24
$27\frac{1}{2}$	$13\frac{5}{8}$	$25\frac{1}{2}$

Not having had the opportunity of seeing skulls of the three northern races of American bighorns, I am unable to say how far these differ from that of the present form. The race is, however, sufficiently characterised by the absence of a mane on the nape of the neck, the long and woolly hair, the small size of the white caudal disk, the great width of the median dark streak by which it is traversed, and the narrowness of the white area on the legs.

At the present time the British Museum possesses the mounted skin of an immature male, which from the great length of the hair is evidently

in the winter coat, although of the usual dark colour. And examples shot by Dr. Guillemard in September, which had likewise assumed their winter dress, were also dark coloured. In the Museum at Tring Park there is, however, the head of a white bighorn killed in Kamschatka during winter. From this it would seem that these sheep are dark-coloured on the first assumption of the winter coat in autumn, but that as winter advances the hairs of this coat turn pure white, precisely in the manner of those of the common stoat in many parts of its habitat. Whether, however, all the individuals of the race thus whiten, or whether the change is restricted to those inhabiting the coldest districts, remains to be determined.

Distribution.—Typically the countries forming the northern shores of the Sea of Okhotsk, namely the peninsula of Kamschatka on the east and the Stanovoi Mountains on the west, and apparently also the Chukchi country to the north, so that the distributional area not improbably includes the districts bordering on Bering Strait. There is also considerable evidence that the range probably extends eastwards through Northern Siberia near to, if not to, the valley of the Yenisei. Middendorff, for example, convinced himself of the existence of a wild sheep eastward from the Yenisei in about latitude 67° N., in the Sywerma Mountains, near the sources of the river Cheta. And it is probably the present or a closely allied race that Severtzoff described under the name of *O. borealis*. The sheep in question was first obtained from the Chalunga and Pjasina valleys in Northern Siberia, and was said to be intermediate between *ammon* and *nivicola*, although much nearer the latter, of which it might turn out to be only a variety. Subsequently the same naturalist wrote of it as follows:—

“Very near to *Ovis nivicola* is another, as yet not properly identified sheep from North Siberia, from the mountains which separate the basins of the rivers Nyjnaya and Tungasca, tributaries of the Yenesei, from that

of the Chalunga and Pjasina. Several perfect specimens of this animal were obtained by Mr. Schmidt's expedition for the Zoological Museum of the Academy of Sciences at Moscow." More recently the same sheep has been recorded by Messrs. Bunge and Toll, in the account of their journey to the New Siberian Islands, from the Upper Lena districts. No specimens are available in England for comparison with the typical Kamschatkan form of this race. If the Siberian form should prove to be distinct, it would have to be known as *O. canadensis borealis*. A point of special interest to determine is whether it really shows any resemblance to the *ammon* type, as suggested in Severtzoff's original description, since, on distributional grounds, such an approximation might reasonably be expected to occur.

Habits.—In the peninsula of Kamschatka, according to Dr. Guillemard, the bighorn, although not unknown in the interior, exhibit a preference for the slopes of the sea-cliffs, where they are found in small flocks of from three to five individuals. Somewhat curiously, all those met with by his party were adult rams, so that the ewes and younger rams evidently herd by themselves for some portion of the year, perhaps keeping to the more inland districts. Some idea of the rugged nature of the ground affected by the rams may be gleaned from the following account given by Dr. Guillemard in the *Cruise of the Marchesa*:—

"Passing beneath the cliff at the entrance to the bay we witnessed the death of a bighorn under unusual circumstances, for these animals are in general as sure-footed as a chamois. A couple of them had been driven into a corner by some members of our party at the top of the cliff, but one broke back almost immediately. The other, perched on a little pinnacle at the edge of the precipice, seemed about to follow its comrade, but hesitated, turned, and ran back. As it did so its foot slipped. It checked itself for a moment, slipped again, made one desperate effort to regain its footing, and was over in an instant. The creature never moved a muscle

as it fell, and hit the rocks 400 feet below with a dull scrunching thud, breaking one of the massive horns short off, and converting the hind-quarters into a shapeless, bleeding pulp."

In the course of about a day and a half's shooting no less than nine adult bighorn rams were bagged by Dr. Guillemard's party.

ii. AMMOTRAGINE GROUP—SUB-GENUS AMMOTRAGUS

Ammotragus, Blyth, *Proc. Zool. Soc.* 1840, p. 13; Gray, *Knowsley Menagerie*, p. 40 (1850), *Cat. Ungulata Brit. Mus.* p. 179 (1852).

Characters.—Horns of males of the same general type as in the next group, but transversely wrinkled when immature; those of females large. No face-glands, and no pits in the skull for their reception. Colour uniformly tawny throughout. A fringe of long hair on the throat, chest, and upper portion of fore-legs. Tail much longer than in any other member of the genus, and with long hair on its lower half.

Distribution.—Northern Africa.

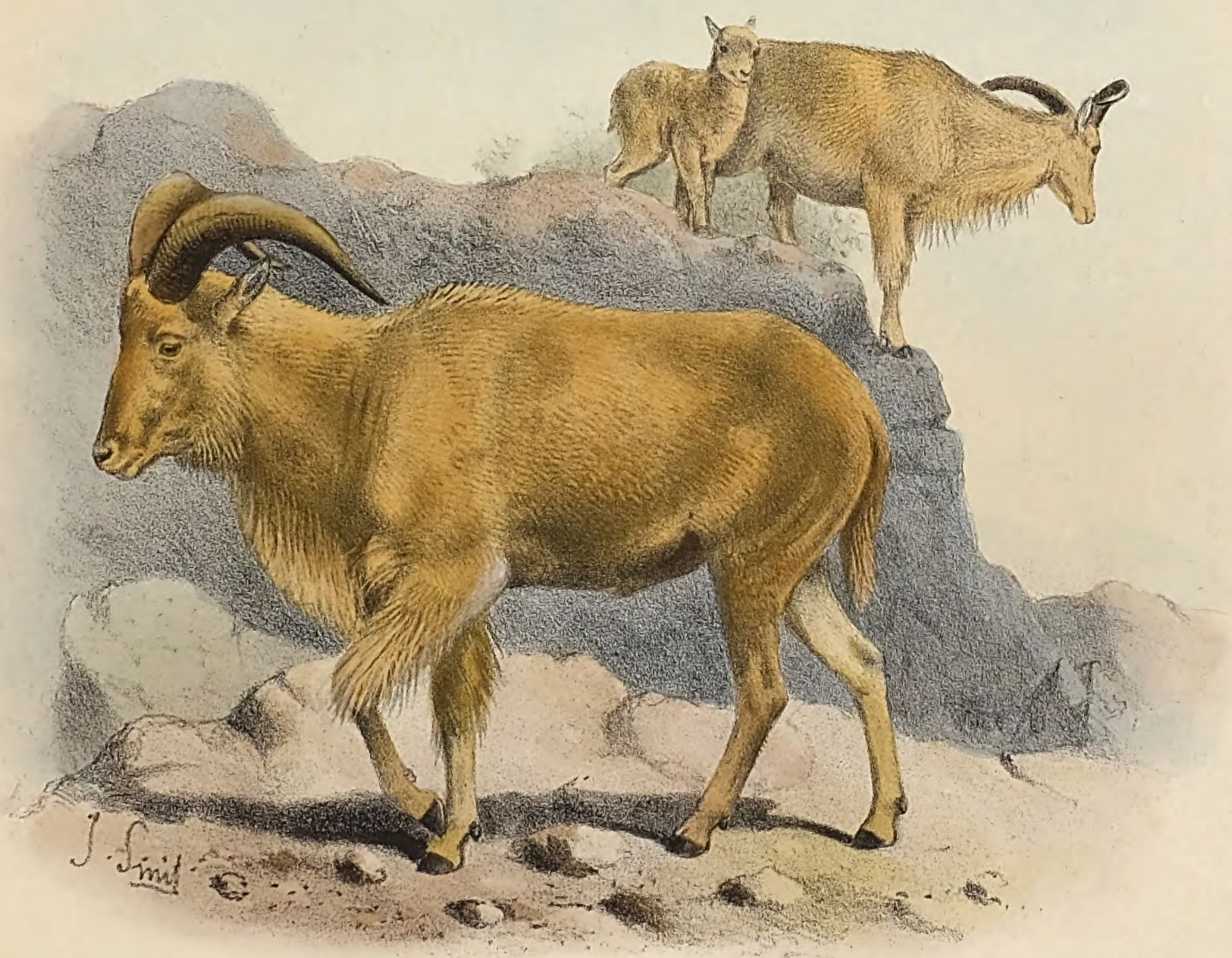
THE ARUI OR AFRICAN SHEEP—OVIS LERVIA

Antilope lervia, Pallas, *Spicil Zool.* fasc. xii. p. 12 (1777).

Ovis tragelaphus, Cuvier, *Règne Animal*, vol. i. p. 268 (1817); Desmarest, *Mammalogie*, vol. ii. p. 486 (1822); H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 319, v. p. 359 (1827); Gray, *List Mamm. Brit. Mus.* p. 169 (1843); Lataste, *Act. Soc. Linn. Bordeaux*, vol. xxxix. p. 288 (1885); W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 141 (1891); Ward, *Records of Big Game*, p. 257 (1896).

Ovis ornata, I. Geoffroy, *Descrip. Egypte—Hist. Nat.* vol. ii. p. 742, pl. vii. (1833).

Ovis (Ammotragus) tragelaphus, Blyth, *Proc. Zool. Soc.* 1840, pp. 13 and 76.



ARUI, OR AFRICAN SHEEP.

Ammotragus tragelaphus, Gray, *Knowsley Menagerie*, p. 40 (1850), *Cat. Ungulata Brit. Mus.* p. 179 (1852), *Cat. Ruminants Brit. Mus.* p. 134 (1872).
Musimon tragelaphus, Gervais, *Hist. Nat. Mamm.* p. 192 (1855).

Plate XVIII.

Characters.—Size comparatively large, the height at the shoulder being about 3 feet 3 inches. Withers relatively tall, and hind-quarters



FIG. 43.—Head of male Arui. (Rowland Ward, *Records of Big Game.*)

low. Head rather long, without face-glands below the eyes, and no pits in the skull for their reception; ears relatively large. A short upright mane extending from the nape of the neck to the middle of the back. In males a fringe of very long and perfectly straight hair commencing on the throat and continued down the middle line to split on the chest and terminate at the origin of each fore-leg; after a short interval continued on the front and outer surface of the leg to a short distance above the knee, below which the hairs depend. Tail long, tufted in its terminal half, and

reaching to within about 5 inches of the hocks. In females the hair shorter. Horns of adult males generally similar in form and curvature to those of the bharal (*infra*, p. 232), but with a distinct keel in the middle of the front surface at the base, and with the tips directed inwards, or inwards and downwards, without any upward tendency; in young specimens the whole horn is marked with prominent sinuous transverse wrinkles, which are often retained at the tips of adult specimens; these wrinkles are wanting in young horns of the bharal, although adult horns of both species show the same sinuous lines of growth. Horns of females only slightly smaller than those of males. General colour of head, upper-parts, outer surface of limbs, and tail uniform rufous tawny, becoming rather darker on the mane; ears, chin, middle of under-parts and inner surfaces of limbs whitish; a few dark bars on the long hair of the throat. Horns yellowish-brown, becoming darker in old animals.

The plate is drawn from an adult mounted male in the British Museum presented by Sir E. G. Loder. This specimen exhibits the average amount of long hair developed on the fore-quarters in the wild state. Menagerie specimens show a much greater profusion of hair. In the characters of the skull and horns the arui is almost as much a goat as is the bharal, although the retention of the transverse wrinklins in the horns for a considerable portion of life is an ovine character. The length of the tail is a feature unknown in the goats, and at first sight might seem to affiliate the species with the domesticated breeds of sheep; from which the arui is, however, widely separated by the absence of face-glands and the form and structure of the horns. In the large size of the horns in the female the species is unlike any other sheep or goat. As regards the elongated hair on the fore-quarters, the present animal comes nearer to the markhor than to any other member of the group, although lacking the long beard growing on the chin of that species. In respect to coloration the arui is nearest to the West Caucasian tur among the

goats, whereas in the same feature the bharal approximates to the Persian wild goat.

By the Arabs the present species is termed either arui, udad, or fechstal.

The following measurements of arui horns are recorded in Mr. Rowland Ward's book :—

Length along Outer Curve.	Basal Circumference.	Tip to Tip.	Locality.
$28\frac{1}{2}$	$11\frac{1}{2}$	$18\frac{3}{8}$	Algeria
$28\frac{1}{2}$	$11\frac{5}{8}$	$18\frac{1}{2}$	„
$27\frac{3}{4}$	$11\frac{1}{4}$	?	„
$26\frac{3}{8}$	$10\frac{3}{4}$	$15\frac{1}{4}$	North Africa
26	11	$17\frac{3}{4}$	„
$25\frac{1}{2}$	$11\frac{1}{2}$	$17\frac{1}{2}$	Algeria
$25\frac{1}{2}$	$11\frac{1}{2}$	17	North Africa
25	$11\frac{1}{4}$	$13\frac{1}{2}$	„
$24\frac{1}{2}$	$10\frac{1}{2}$	$19\frac{1}{2}$	„
20	?	?	„
$19\frac{7}{8}$	$10\frac{1}{8}$	$15\frac{1}{4}$	Atlas
$19\frac{5}{8}$	10	$15\frac{1}{4}$	„
$19\frac{1}{4}$	$9\frac{1}{4}$	$16\frac{3}{4}$	Djebel Matlili
$18\frac{1}{4}$	$7\frac{1}{2}$	$14\frac{1}{4}$	North Africa
$17\frac{3}{4}$	$9\frac{1}{2}$	$13\frac{3}{4}$	Atlas
17	$7\frac{1}{2}$	?	„

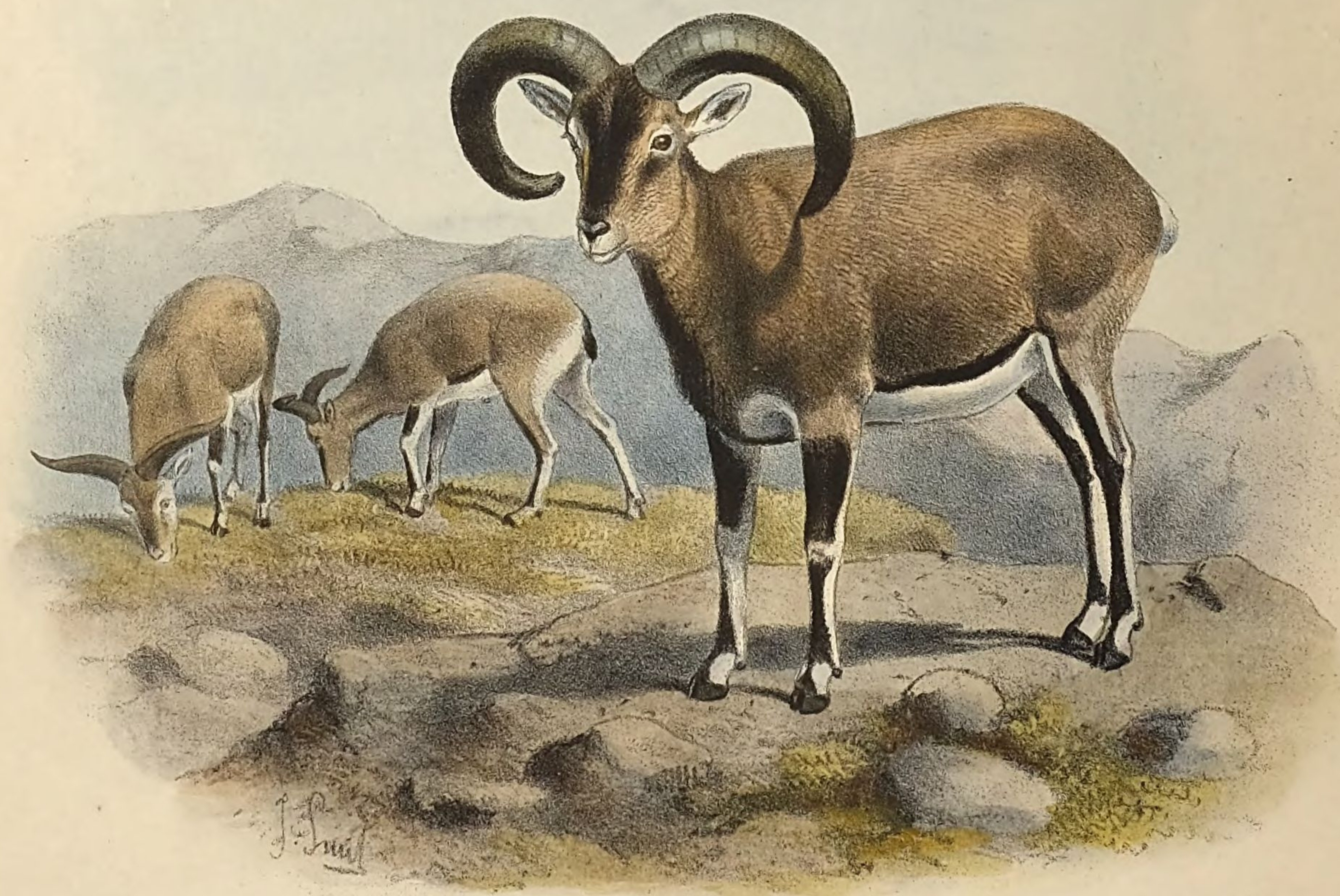
In this list the last and antepenultimate specimens are those of females.

Distribution.—The mountains of North Africa, from near the Atlantic seaboard to Egypt. In the Atlas confined to the arid southern slopes, within sight of the desert, and unknown in the interior of the range in the neighbourhood of the coast.

Habits.—The uniform tawny coloration of the arui is of itself sufficient to proclaim that the animal is an inhabitant of comparatively bare sandy or rocky districts ; and this we find confirmed by the accounts of those who have seen it in its native haunts. Among recent observers, Mr. E. N.

Buxton has put on record some excellent notes on the habits of the animal, from which the following is paraphrased.

Arui inhabit districts where the cliffs are formed of reddish and yellowish rocks, among which the rufous tawny of their coat renders them so inconspicuous that, although by no means uncommon, they are extremely difficult to detect. Throughout the district water is extremely scarce, and, according to Arab reports, the sheep seldom, if ever, drink more than once in four or five days, so that they are easily able to undertake long journeys in search of liquid. They never enter the cedar forests, where the climate is moister, and appear to inhabit much more broken and precipitous ground than the majority of wild sheep; this trait confirming their affinity to the goats. As the Arabs have taken possession of all situations in the mountains where water is to be met with, the arui have been compelled to accustom themselves to the near presence of man and the flocks of domestic goats by which, in these districts, he is accompanied. To avoid the nomads and their flocks, the arui are constantly shifting their quarters; and they have by long use grown accustomed to selecting sites for repose where, while practically invisible themselves, they can obtain a good view of their surroundings. Arui generally go about in small parties of four or five, not unfrequently a ewe being seen accompanied only by a pair of yearling lambs. In captivity they thrive well and breed freely; the lambs, of which there may be either one or two at a birth, being produced after a gestation of about one hundred and sixty days. It may be noted that the coloration of the arui is almost identical with that of the bubaline hartebeest (*Bubalis boselaphus*) which inhabits the deserts of Northern Africa, although it has now retreated south of the Atlas. In the edmi gazelle (*Gazella cuvieri*), which inhabits actually the same districts as the arui, the colour of the upper-parts is rather paler, while the under-parts and much of the legs are white, and the tail-tip black. Both the edmi and the arui assimilate so closely to their surroundings as to be



BHARAL, or, BLUE SHEEP.

very difficult of detection. A sub-fossil cannon-bone from one of the French caverns has been referred to this species, but it seems extremely doubtful if the determination is really correct.

Although the arui is undoubtedly very distinct from all other wild sheep, perhaps even more so than the bharal, I cannot bring myself to regard it as worthy of generic distinction. Its most aberrant features are the mane of long hairs on the fore-quarters, the length of the tail, and the relatively large size of the horns in the female.

iii. PSEUDOVINE GROUP—SUB-GENUS PSEUDOIS

Pseudois, Hodgson, *Journ. As. Soc. Bengal*, vol. xv. p. 343 (1846); Gray, *Cat. Ungulata Brit. Mus.* p. 177 (1852).

Characters.—Horns of males forming an S-shaped curve, rounded or subquadrangular at the base, nearly smooth, without distinct transverse wrinkles; those of females small. No face-glands, or pits in the skull for their reception. A clearly-defined black band between the fawn of the back and the white of the under-parts, and distinct black markings down the whole front of the legs. No fringe of hair on the throat and fore-legs. Tail rather longer than in the caprovine group.

Distribution.—Tibet and adjacent districts of Central Asia.

THE BHARAL—OVIS NAHURA

Ovis nayaur, Hodgson, *Asiatic Researches*, vol. xviii. pt. 2, p. 135 (1833), in part; Matschie, *SB. Ges. natf. Berlin*, 1896, p. 97, 1897, p. 72.

Ovis nahoor, Hodgson, *Proc. Zool. Soc.* 1834, p. 107, *Journ. As. Soc. Bengal*, vol. x. pp. 231 and 293 (1840), xi. p. 283 (1842), P. L. Sclater, *Proc. Zool. Soc.* 1860, p. 129; Kinloch, *Large Game Shooting*, pt. 1, p. 25 (1866); Milne-Edwards, *Rech. Mamm.* p. 357, pls. lxviii. and lxix. (1868-74); W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 140 (1891).

Ovis burrhel, Blyth, *Proc. Zool. Soc.* 1840, p. 67, *Ann. Mag. Nat. Hist.* ser. 1, vol. vii. p. 248 (1841), *Journ. As. Soc. Bengal*, vol. x. p. 868 (1841).

Ovis nahura, Gray, *List Mamm. Brit. Mus.* p. 170 (1843); Jerdon, *Mamm. India*, p. 296 (1867); Blanford, *Journ. As. Soc. Bengal*, vol. xli. p. 40 (1872), *Yarkand Miss.—Mamm.* p. 85, pl. xiv. (1879), *Fauna Brit. India—Mamm.* p. 499 (1891); Sterndale, *Mamm. India*, p. 438 (1884); Ward, *Records of Big Game*, p. 253 (1896).

Pseudois nahoor, Hodgson, *Journ. As. Soc. Bengal*, vol. xv. p. 343 (1846), xvi. p. 702 (1847); Horsfield, *Cat. E. Ind. Mus.* p. 176 (1851); Gray, *Knowsley Menagerie*, p. 40 (1850), *Cat. Ungulata Brit. Mus.* p. 177 (1852), *Cat. Ruminants Brit. Mus.* p. 133 (1872); Adams, *Proc. Zool. Soc.* 1858, p. 527; Lydekker, *Journ. As. Soc. Bengal*, vol. xlix. p. 131 (1880); Prezewalski, *Cat. Zool. Coll.* p. 16 (1887).

Musimon nahoor, Gervais, *Hist. Nat. Mamm.* vol. ii. p. 191 (1855).

Pseudois burrhel, Prezewalski, *Cat. Zool. Coll.* p. 16 (1887).

Pseudois nahura, Nathusius, *Zool. Anzeiger*, 1888, p. 333; Langkavel, *Zool. Garten*, vol. xxx. p. 298 (1889).

Plate XIX.

Characters.—Size medium, the height at the shoulder being about 3 feet. Head long and narrow; hair of uniform length throughout, showing no trace of either mane or ruff; ears short; horns of adult males rounded or subquadrangular at the base, nearly smooth, with the distinct transverse wrinkles of the more typical sheep replaced by widely separated sinuous lines of growth and also by fine striæ, arising close together, curving outwards, at first upwards, then downwards, and finally backwards, so that the tips, which are inclined inwards, are situated over the withers. In females the horns are short, curved slightly upwards and outwards, and suboval in section, with their longer diameter transverse to the head.

General colour of upper-parts brownish-gray, with a tinge of slaty-blue, becoming browner in summer, and more distinctly slaty-gray, washed with brown, in winter; under-parts, inside and back of limbs, and buttocks as far as the base of the tail white; in adult rams the face, chest, a stripe down the whole front of the legs except the knees, which are white, a band along the lower part of the flanks bordering the white of the under-parts, and the terminal two-thirds of the tail white. In the females the black markings on the



FIG. 44.—Head of male Bharal. (Rowland Ward, *Records of Big Game*.)

face, chest, and flanks wanting. Colour of horns blackish-olive. The weight of a full-grown male bharal is about 130 pounds.

With regard to the systematic position of the bharal, Mr. Brian Hodgson long ago pointed out that it differed from the more typical sheep by the absence of face-glands and the pits for their reception in the skull; this being a feature in which it resembles the goats. He also pointed out that the tail is more like that of a goat than of a sheep. In a paper communicated to the *Journal of the Asiatic Society of Bengal* in 1880, I pointed out other features in which the bharal differs from the typical sheep and approximates to the goats. It is there stated that an important caprine feature is to be found in the form of the basioccipital bone, or that element forming the hinder extremity of the base of the skull.

In the true goats this bone is oblong in shape, with a pair of tubercles at the posterior and anterior extremities ; of these, the posterior pair are considerably the larger and more prominent, but both are situated in the same antero-posterior line. In the true sheep, on the other hand, the basioccipital is always considerably wider in front than behind, while the anterior tubercles are much larger than the posterior pair and are placed further apart. The basioccipital of the bharal agrees exactly with that of the goats, and is consequently widely different from this part in the sheep.

In the structure of its horns the bharal again presents caprine affinities. In the true sheep the horns are always thrown into parallel transverse wrinkles extending completely round them ; the colour of the horns is light or greenish-brown, and the direction of the extremity of the first curve is downwards and forwards. In the goats, on the other hand, the horns are never thrown into coarse and parallel transverse wrinkles, but are marked by finer striæ, and may or may not carry knobs anteriorly. Their colour is olive- or blackish-brown ; they are generally more or less angulated, and the extremity of the first curve is directed backwards and upwards. In the bharal the structure and colour of the horns are the same as in the goats. It is true their angulation is less marked and their direction is more outward than in ordinary goats, but in both respects they are paralleled by the horns of the East Caucasian tur. Indeed, the resemblance between the horns of these two animals is so striking, that the one last-named is frequently spoken of by sportsmen as the Caucasian bharal. It may be added that the upward twist of the extremities of the horns of the bharal presents an approximation to the spiral horns of the markhor, and is quite different from the curve of an ordinary sheep's horn. As already mentioned, the Asiatic muflon makes the nearest approach of any member of the caprovine group to the bharal in the curvature of its horns.

Externally, the bharal is distinguished from the goats by the absence of any strong odour or of any trace of a beard in the males. There are glands between the hoofs of all four feet in the bharal ; and in this respect the animal agrees with the sheep and differs from the goats, in which these are either present in the fore-feet alone or are wanting altogether. The black markings on the head, body, and limbs are very like those found in some of the goats.

In concluding the paper from which the above extracts have been paraphrased, I considered that the bharal should be generically separated from the sheep, and made the type of a distinct genus, for which Hodgson's name *Pseudois* should stand. The same view has been subsequently urged by Dr. Matschie, who has recapitulated the foregoing observations, and added that in its thick and clumsy legs and the form of the feet, the bharal is decidedly more of a goat than a sheep.

So far as the structure of the skull and form of the horns are concerned, this must, I think, be admitted ; but, on the other hand, the absence of a beard, as well as of the characteristic odour of the goats, in the males, and the presence of glands in all the four feet are essentially sheep-like characters. And in some undoubted sheep, like the bighorn, the face-glands are so small, that it would only be what we might expect to find them wanting in another species of the same genus. As to the characters of the legs and tail, on which Dr. Matschie lays considerable stress, I fail to see that they afford any decisive evidence one way or the other. It is urged that the tail of the bharal is thinner and more pointed than in the sheep ; but in the larger sheep like *O. poli* and *O. ammon* this appendage when covered with the thick winter coat looks broad and blunt, while in the summer pelage it appears thin and pointed.

That the bharal affords a connecting link between the more typical sheep and the goats, must undoubtedly be admitted by all ; and if any change in the generally accepted systematic arrangement were made, it

appears to me that it would be desirable to include both groups in a single genus. Without proceeding to this extreme course, the difficulties of the case may be fairly met by regarding the bharal as the representative of a separate sub-generic group of *Ovis*, leading on from the caprovine group in the direction of the goats.

On this difficult point Mr. Blanford writes as follows :—"This animal in structure is quite as much allied to *Capra* as to *Ovis*, and is referred to the latter genus mainly because it resembles sheep rather than goats in general appearance, and hence has been generally classed with the former. Hodgson distinguished it as *Pseudois*, and there is much to be said in favour of the distinction, but the sheep and goats are so nearly allied that an intermediate generic form can scarcely be admitted." The following are some of the largest measurements of the horns of this species recorded by Mr. Rowland Ward :—

Length along Front Curve.	Basal Circumference.	Tip to Tip.
32	?	?
$31\frac{1}{2}$	$13\frac{1}{2}$	$22\frac{1}{2}$
$30\frac{7}{8}$	$12\frac{1}{4}$	$21\frac{7}{8}$
$30\frac{1}{2}$	11	$15\frac{1}{2}$
$29\frac{1}{2}$	$11\frac{5}{8}$	$25\frac{1}{2}$
$28\frac{1}{2}$	?	?
$28\frac{1}{2}$	$12\frac{1}{4}$	$26\frac{1}{2}$
28	11	$20\frac{1}{4}$
$27\frac{3}{4}$	$10\frac{1}{4}$	10
$27\frac{1}{4}$	11	$21\frac{1}{2}$
27	?	?
27	$11\frac{1}{2}$	28
$26\frac{3}{4}$	$11\frac{1}{2}$	23
$26\frac{1}{2}$	$10\frac{1}{2}$	20
$26\frac{1}{4}$	$11\frac{7}{8}$	23
$26\frac{1}{4}$	12	$21\frac{1}{4}$
$26\frac{1}{4}$	$10\frac{3}{4}$	22
26	12	$20\frac{1}{8}$
$25\frac{7}{8}$	$12\frac{1}{2}$	$31\frac{1}{2}$

Length along Front Curve.	Basal Circumference.	Tip to Tip.
$25\frac{7}{8}$	$11\frac{1}{4}$	$18\frac{1}{2}$
$25\frac{1}{2}$	$11\frac{1}{2}$	?
$25\frac{3}{8}$	$11\frac{1}{4}$	$25\frac{1}{4}$
$24\frac{1}{2}$	$12\frac{1}{4}$	26
$24\frac{3}{8}$	$10\frac{7}{8}$	$27\frac{1}{4}$
24	11	$22\frac{3}{4}$

Distribution.—Tibet, from the neighbourhood of Shigar in Baltistan in the west to Moupin in the east, and from the main axis of the Himalaya in the south, or in places in the high country somewhat southwards, to the Kuenlun and Altyn-tag in the north. Apparently never descending below an elevation of about 10,000 feet above the sea-level, and in summer commonly met with at elevations of from about 14,000 to 16,000 feet, or even higher.

Habits.—Bharal is the Hindustani title of this very aberrant and peculiar sheep, but its proper Ladaki name is na or s'na. By Englishmen it is very commonly known as the blue sheep, a name admirably denoting that peculiarity of coloration whereby it is so strikingly different from all its kindred. As structure is intimately correlated with habits, it is not surprising to find the blue sheep displaying in its habits features common to the goats on the one hand and to the sheep on the other. For instance, while resembling sheep in dwelling on open undulating ground, and in displaying a frequent tendency to repose during the midday hours on its feeding-places, the bharal rivals the goats in its climbing capabilities, being able to ascend precipitous cliffs with facility, and when disturbed generally resorting to ground which it would try the most skilled and active mountaineer to ascend. Although these observations are not my own, I am able to confirm their accuracy from the results of personal experience. On one occasion, when travelling in Ladak, on the southern side of the great mountain-barrier bordering the south side of the Indus opposite the town of Leh, I came suddenly and unexpectedly on a large flock of bharal, the

members of which were lying on the grass of an open valley, and on being disturbed immediately took to the precipitous hills on each side. Although it was late in summer, the herd consisted both of rams and ewes ; male bharal at this season sometimes herding by themselves, but in other instances remaining with the flock. Before taking to flight, some of the adult rams turned round to look, as is so generally the custom with both sheep and goats ; and the skulls of two are now in the British Museum. The number of individuals in a flock usually varies from ten or less to about fifty, although sometimes as many as a hundred may be seen together. In much of the bharal-ground in Ladak there is no covert of any description, but some of the valleys are clothed along the bottom with thick *Eleagnus* jungle, the resort of numerous hares. The bharal, however, always avoid covert of any description, keeping entirely to the open. The slaty-blue of their hair harmonises so exactly with the general tint of the slaty and gneiss rocks so common in Ladak, that a flock of bharal lying down in a grassy valley where masses of rock protrude through the turf are very difficult to distinguish ; and on the occasion referred to above, it is doubtful if I should have recognised the presence of the bharal in time to shoot had it not been for my Tatar guide. In Ladak, at least, these sheep do not appear to have any particular feeding-times, but graze and repose alternately during the day as the inclination takes them. In some districts on the Upper Indus not only do the rams separate themselves from the rest of the flock, but actually betake themselves to different valleys during the summer. Bharal and ibex have been seen on the same ground but not actually feeding together, although bharal and tahr have been observed grazing in company to the south of the Niti Pass.

The pairing season and the length of the period of gestation do not seem to have been accurately determined. Bharal thrive well in confinement, and have bred freely in the London Zoological Gardens. They show no tendency to cross with domesticated sheep.

Where bharal occur at all, they are usually met with in abundance, and in undisturbed districts are perhaps the easiest of all Tibetan big game to stalk. General Kinloch states, however, that in places where they have been much hunted they soon become extremely shy and wary, and require great care in stalking, as they are frequently in the habit of stationing sentries in commanding positions while the other members of the flock are grazing. The flesh of all the wild sheep of Central Asia is of excellent quality, and in this respect that of the bharal stands second to none.

I am informed by a correspondent that, unlike domesticated rams, the male bharal in the London Zoological Gardens, when charging each other, rise on their hind-legs after the manner of goats previous to the impact.

IV. THE GOATS—GENUS CAPRA

Capra, Linn. *Syst. Nat.* ed. 12, vol. i. p. 94 (1766); H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 300, v. p. 356 (1827).

Hircus, Boddaert, *Elenchus Animal*, p. 147 (1785); Gray, *Cat. Ungulata Brit. Mus.* p. 153 (1852).

Ægoceros, Pallas, *Zoogr. Rosso-Asiat.* vol. i. p. 224 (1811).

Ibex, Hodgson, *Journ. As. Soc. Bengal*, vol. xvi. p. 700 (1847); Gray, *List Osteol. Brit. Mus.* p. 59 (1847).

Ægoceros, Gray, *Cat. Ungulata Brit. Mus.* p. 148 (1852), *Cat. Ruminants Brit. Mus.* p. 52 (1872), *nec* Pallas, 1811.

Characters.—Closely allied to *Ovis*, with which this genus agrees in almost all essential characters. Size medium and build rather stout. Tail short. No glands either on the face or in the groin, and foot-glands either wanting or confined to the fore-feet. Muzzle hairy; a more or less distinct beard on the chin of the males. Female with two teats. Hard callosities present on the knees and sometimes also on the chest. Males with a strong unpleasant odour. Horns present in both sexes; in the adult males arising

close together on the head and of great length, more or less compressed and angulated, and rising above the plane of the forehead either in a scimitar-like curve or a spiral ; those of females much smaller and placed further apart at the base.

Skull without gland-pits below the eyes ; broad across the sockets of the latter, and narrowing somewhat suddenly below ; the planes of the occiput and of the forehead meeting one another at an obtuse angle ; occipital and parietal region much rounded ; profile of face concave.

Comparing the above definition with that of the genus *Ovis* given on p. 149, it will be found that the points of difference of the goats are the absence of glands in the hind-feet, the presence of a beard in the males, the strong odour exhaled by the latter sex, and certain details in regard to the conformation of the skull. The horns form no criterion, since those of the bharal are very like those of the East Caucasian tur, in which also the beard is but very slightly developed. Had we only the sheep of the caprovine group on the one hand and the more typical goats on the other to deal with, there would be hesitation in admitting the propriety of assigning the two groups to separate genera. But the arui, the bharal, and the tur form such a connecting chain that the advisability of the distinction appears to me doubtful.

This was recognised as far back as the year 1811 by the Russian naturalist and traveller Pallas, who referred all these animals to his genus *Ægoceros*, although of course *Capra* ought to have been employed in the same sense, as coming in the Linnean system before *Ovis*. Similarly Bennett¹ in 1835 wrote as follows :—"There are two principal difficulties in the natural history of the sheep, each involving questions of considerable importance, but neither of them admitting, in the present state of our knowledge, of a perfectly satisfactory solution. The first relates to the propriety of the generic distinction between the sheep and goats, which

¹ *The Gardens and Menagerie of the Zoological Society Delineated*, vol. i. pp. 259 and 261.

naturalists have borrowed from the vulgar classification, adopting it in many instances against their better judgment. . . . The horns, too, vary so extensively in both cases, and the convexity of the line of profile is subject to so many modifications, as to render the distinctions drawn from their characters of no practical value. On the presence or absence of the beard it would be absurd to dwell as offering the semblance of a generic character, to distinguish between animals which actually produce together a mixed breed capable of continuing their race. From all these conclusions we are led to infer that the sheep and the goat cannot properly be said to form the types of separate genera."

With this judgment I am very much inclined to agree, although, in order to avoid complicating matters by a change of names which may not meet with acceptance, I have thought it advisable to retain the ordinary scheme of classification.

By Dr. Gray the goats here included under the heading *Capra* were divided into (1) *Ægoceros*, (2) *Capra*, and (3) *Hircus*; the first division including the tur, the second the ibex, and the third the common goat and markhor. This, however, is obviously incorrect. If such divisions, whether generic or subgeneric, are adopted at all, *Capra* obviously belongs to the common goat. In Pallas's description of his genus *Ægoceros* the species first mentioned is *Æ. ibex*, so that this generic term must stand for the ibex group, thus superseding the later *Ibex* of Hodgson, and leaving the tur without a separate designation at all.

Bearing in mind, therefore, that if sub-generic divisions of *Capra* are adopted, a new term would be required for the tur group, and seeing that the various groups of goats intergrade to a very great degree, I have considered it advisable to make no such divisions at all.

Distribution.—At the present day the mountainous districts of the Eastern Holarctic region, impinging on the Oriental region in the Himalaya, and with one outlying species in the mountains of the north-

eastern quarter of the Ethiopian region. Goats do not range so far north as sheep, which may be one reason why they have never succeeded in obtaining an entrance into North America *via* Bering Strait. During the cold conditions which obtained in part of the Plistocene epoch they appear to have been able to exist in Europe near the sea-level. Geologically they seem an essentially modern group, scarcely any well-defined extinct species having been described. The earliest appears to have been a species allied to the markhor from the Pliocene deposits at the foot of the Himalaya; this species, like the existing Suleman markhor, having evidently lived at a comparatively low elevation above the sea, and probably therefore having been capable of bearing a high temperature.

Habits.—All living goats are dwellers on steep cliffs and display remarkable powers of climbing. In this respect they differ markedly from most of the larger sheep of the caprovine group, which, as mentioned above, prefer open rolling valleys and plateaux. The bharal, the arui, and apparently also the Kamschatkan bighorn, form, however, to a great extent a transition in this respect between the other sheep and the goats, so that no argument drawn from their habits can be urged as a confirmation of the need of generically separating the two groups. All the various species of goats associate in herds, although in many cases the old males keep apart from the females during the greater part of the year. When they live in regions where trees or bushes flourish, goats are fond of browsing; and they are all notable for their wariness and difficulty of approach. In tame goats the period of gestation, according to Hodgson, is about 160 days.

1. THE EAST CAUCASIAN TUR—CAPRA CYLINDRICORNIS

Ovis cylindricornis, Blyth, *Proc. Zool. Soc.* 1840, p. 68.

Ægoceros pallasii, Rouiller, *Bull. Soc. Moscou*, vol. xiv. p. 908, pl. xi. (1841).



EAST CAUCASIAN TUR.

Capra caucasica, Keyserling and Blasius, *Wirbelth. Europ.* p. 28 (1840); Blasius, *Säugeth. Deutschlands*, p. 479 (1857); P. L. Sclater, *Proc. Zool. Soc.* 1886, p. 315, *nec* Pallas, 1783.

Ovis pallasii, Reichenbach, *Naturgeschichte Wiederkauer*, pl. xlix. (1846).

Ægoceros caucasica, Gray, *Cat. Ungulata Brit. Mus.* p. 148 (1852), *nec* *Capra caucasica*, Pallas, 1783.

Capra pallasii, Radde, *Proc. Zool. Soc.* 1887, p. 553; Ward, *Records of Big Game*, p. 235 (1896).

Capra cylindricornis, Büchner, *Mém. Acad. St. Pétersbourg*, vol. xxxv. No. 8, p. 21 (1887); Menzbier, *Proc. Zool. Soc.* 1887, p. 618; Satunin, *Zool. Jahrb. Syst.* vol. ix. p. 312 (1896); Ward, *Records of Big Game*, p. 235 (1896).

Plate XX.

Characters.—Build heavy and clumsy, with the head rather short and blunt; height at shoulder about 38 inches; horns large and massive, widely separated at the base, nearly cylindrical in section, with more or less indistinct transverse ribs, but no knots; their direction at first outwards and slightly upwards, and then backwards, downwards, and inwards. Beard confined to the chin; in the form of a short, broad fringe, curling distinctly forwards. Pelage (? in winter) moderately long and thick; its general colour uniform dull brown, except on the chin, the tip of the tail, the front and inner sides of the hind-legs, and the front of the fore-legs below the knees, which are blackish-brown or black; no white on the legs. Beard similar in colour to the rest of the pelage; horns dark blackish-olive.

Although typical specimens of the present species are so widely different from the next, there has been an extraordinary amount of confusion between the two animals; and certain specimens of horns occur which are in some

respects intermediate between the typical form of each. Dr. Radde, for instance, remarks that he has seen very old horns referred to the present species, which curve almost in a single plane, with the points turned in a half-crescent shape towards one another, and thus very like those of the western species. These horns not improbably belong to the presumed hybrid form referred to under the heading of the latter.

In common with the following, this species is known locally as the



FIG. 45.—Head of male East Caucasian Tur. (Rowland Ward, *Records of Big Game*.)

tur, a name which may be well adopted in English. By sportsmen it is frequently termed the Caucasian bharal, and its horns are certainly very like those of the true bharal. But it is very doubtful if there is any specially close relationship between the two animals; the similarity in the form of the horns being a character which might readily be acquired quite independently. The bharal has no beard, and its coloration is totally different from that of either of the Caucasian tur, which are remarkable among the goats for the uniformly brown tint of their pelage.

The following horn-dimensions are recorded by Mr. Rowland Ward :—

Length along Front Curve.	Basal Circumference.	Tip to Tip.
$38\frac{1}{4}$	$12\frac{1}{2}$	?
$34\frac{1}{2}$	$10\frac{7}{8}$	$13\frac{1}{2}$
$33\frac{3}{8}$	12	$19\frac{3}{4}$
31	11	28
$29\frac{1}{2}$	12	20
$28\frac{1}{2}$	11	$16\frac{1}{2}$
$26\frac{1}{2}$	$10\frac{5}{8}$	18
$22\frac{1}{2}$	$10\frac{3}{4}$	$19\frac{1}{2}$
$20\frac{1}{2}$	10	$11\frac{1}{2}$

Distribution.—The Eastern Caucasus, from Daghestan to Kasbeg.

Habits.—Few English sportsmen have followed this tur in its native haunts, and accounts of its habits are therefore scant and imperfect. According to Mr. C. Phillipps-Wolley, who has given some brief notes on it in the *Badminton Library*, this tur inhabits the higher mountain crags in situations where either large springs of iron-impregnated water, or “licks” of the same occur. To such springs or licks the tur, if possible, descend at least once during the twenty-four hours, and it is then that so many of them fall victims to the concealed watcher. At least during the summer months, from the beginning of June till the end of August, the tur during the day-time keep to the bare crags well above the snow-line, free from attack by either man or insects, and in a situation where the sun’s rays do not strike with the force they exert in the valleys below. With the approach of night the rattling of stones from the moraines of the glacier proclaims to the hunter that the tur are descending to feed upon the patches of upland pasture; their presence in the gathering gloom being revealed by the shrill bleat from which they gain their local name of djik-vi. According, however, to native reports, it is only the younger rams and ewes, which associate in large herds, that come down to the licks and pastures during the summer, the old rams keeping themselves apart, and living entirely above the snow-line among almost inaccessible fastnesses. It is there that the sportsman must penetrate if he desire to bag trophies worthy of his reputation during

the summer months. Like ibex and other goats which live where avalanches are constantly falling and stones are dislodged from glacier moraines at every movement, the tur is very indifferent to noises of all descriptions, and relies for safety on the keenness of its senses of scent and vision.

2. THE WEST CAUCASIAN TUR—CAPRA CAUCASICA

Capra caucasica, Pallas, *Acta Acad. Petrop.* vol. iii. pt. 2, p. 273, pls. xviiA. xviiB. (1783); Dinnik, *Ann. Mag. Nat. Hist.* ser. 5, vol. xix. p. 450, pl. xiv. (1887); Büchner, *Mém. Acad. St. Pétersbourg*, vol. xxxv. No. 8, p. 16, pl. ii. (1887); Menzbier, *Proc. Zool. Soc.* 1887, p. 618; Satunin, *Zool. Jahrb. Syst.* vol. ix. p. 311 (1896); Ward, *Records of Big Game*, p. 227 (1896).

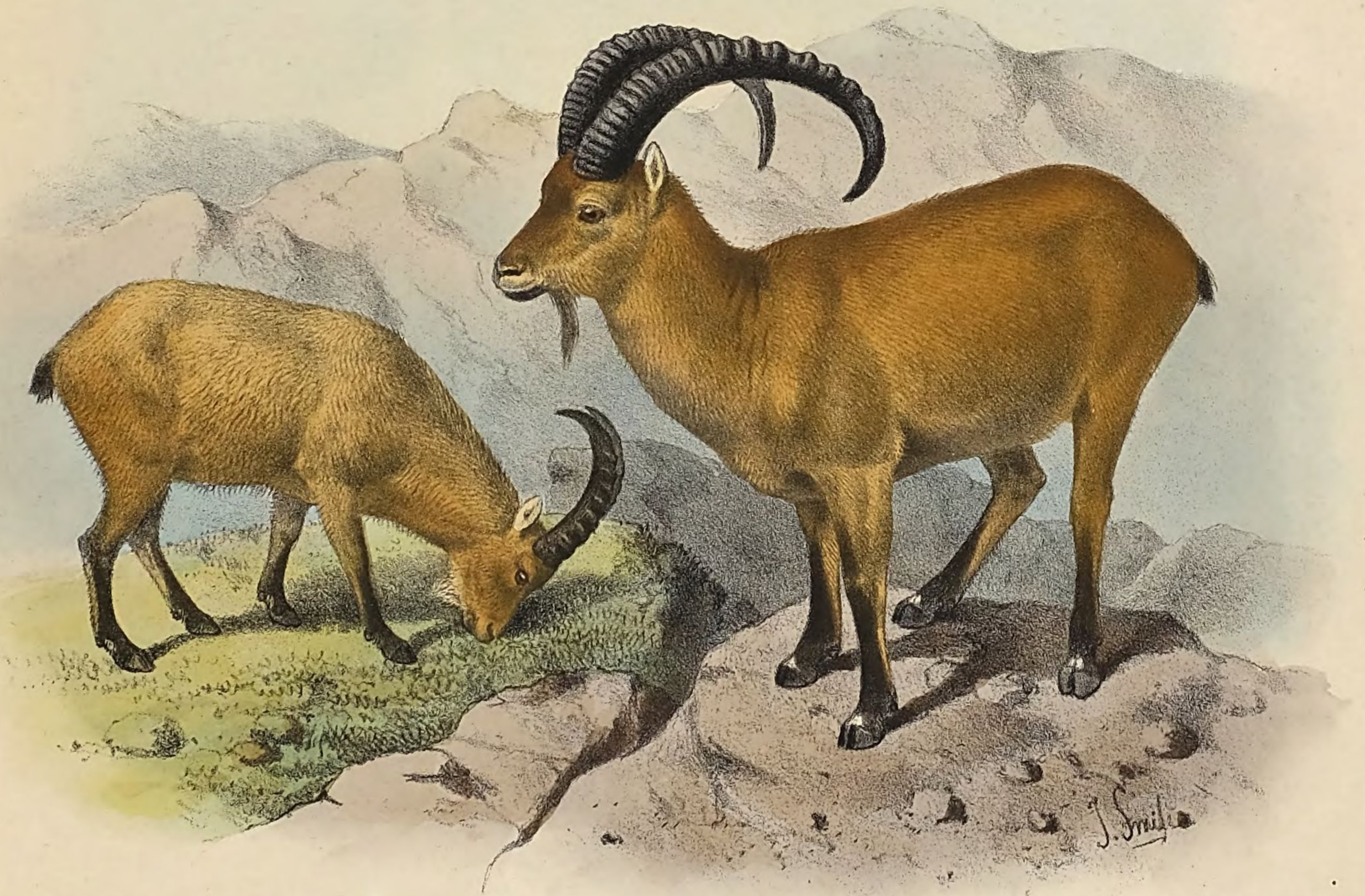
Ægoceros ammon, Pallas, *Zoogr. Rosso-Asiat.* vol. i. p. 221 (1811), nec *Capra ammon*, Linn. 1766.

Capra severtzowi, Menzbier, *Proc. Zool. Soc.* 1887, p. 619.

Capra severzowi, Satunin, *Zool. Jahrb. Syst.* vol. ix. p. 312 (1896).

Plate XXI.

Characters.—Build heavy and massive, with the face short and blunt, the height at the shoulder being about $37\frac{1}{2}$ inches. Horns large and massive in adult male, widely separated on the forehead, nearly quadrangular in section; the broad anterior surface bearing in its basal half low flat ribs, and its terminal half bold knots or knobs; from the skull the horns diverge at an angle of about 45 degrees, and curve upwards, outwards, and backwards nearly in the same plane, except near the tips, where they are inclined somewhat inwards. In the young male they are shorter, with knots along the whole length of the front surface. Beard confined to the chin; long and narrow in summer; broader in winter, when in young males it forms only a short fringe. Summer pelage short and close, of a uniform bright chestnut-brown colour, with the lower lip, chin, the root of the beard, the tip of the tail, and the front of the legs below the knees and hocks



WEST CAUCASIAN TUR.

black or blackish ; a more or less distinct light stripe on the back of the lower portion of the legs, and a white spot on the fore-pasterns above the cleft of the hoofs ; no dark line on back. In winter the hair much longer and coarser. In young males at this season the general colour is light yellowish-brown, with the same dark markings on the chin, tail, and legs, and also an



FIG. 46.—West Caucasian Tur. (From Prince Demidoff's *Hunting Trips to the Caucasus*.)

ill-defined dark line down the middle of the back ; the margins of the lips being whitish, and the white spot above the front hoofs wanting. In young females more white is shown on the muzzle. Beard, except at the roots, similar in colour to the rest of the pelage ; horns and hoofs deep black.

The form of the horns, their wide separation at the base, the uniform chestnut hue of the summer pelage on the upper-parts, the white spot

on the front pasterns, and the similarity between the colour of the long narrow beard and the back are characters amply sufficient to distinguish this species from all its kindred.

This splendid goat was originally described by Pallas from specimens collected by Güldenstädt, near the head-waters of the rivers Terek and Kuban, which rise in the Central Caucasus on the north side of the chain between Elbruz and Dych-tau. The figured specimens comprise a female (plate xviiA.) and the head of an adult male (plate xviiB. fig. 1). In the male head the beard is long and narrow ; and the horns, which appear to curve in a single plane, are boldly knotted on the front surface of their terminal half. As they are not those of a very old animal, they are separated by a considerable interval at their tips.

In the *Proceedings* of the Zoological Society for 1886 Mr. Sclater believed *Capra cylindricornis* to be inseparable from this species, and described it from specimens of the former. But in 1887 Herr Dinnik described and figured characteristic horns from the Western Caucasus, while others were figured by Dr. Büchner in the same year. None of these specimens belong, however, to very old animals, so that the interval between the tips of the horns is relatively large.

In the latter part of 1887 Dr. M. Menzbier communicated a paper to the Zoological Society in which he restricted *Capra caucasica* to the Central Caucasus (the typical locality), and referred all the specimens from the Western Caucasus (including those described by Messrs. Dinnik and Büchner) to a new species, under the name *Capra severtzowi*. Unfortunately no figures accompanied this communication. It is stated, however, that the goat regarded as the true *C. caucasica* has horns somewhat intermediate between those of *C. cylindricornis* and the goat of the Western Caucasus ; and that these horns always have the tips approximated, the distance between them being only about 20 inches. The horns are further stated to show eight or nine small ribs on the basal half of the front surface,

and about ten more conspicuous nodules in the terminal half. Furthermore, the beard is described as being short and broad, like that of the East Caucasian tur.

On the other hand, in the western form described as *C. severtzowi* the horns, which bear more or less conspicuous nodules on the front surface, are stated to curve in one plane, and to be widely separated at the tips, the distance between which is given at from 32 to 36 inches. The beard is described as long and narrow. Certain differences in colour and the form of the incisor teeth are also mentioned ; but as I believe these to be entirely due to season and age, attention will be restricted to the horns and beard. The following specimens from the Central and Western Caucasus have come under my personal notice. Firstly, two young mounted males in the British Museum from Mount Elbruz, showing the long winter pelage. In the larger of these two the short horns are knotted in front throughout their length ; and the beard in both is of the short, broad type, characteristic of the East Caucasian tur. Secondly, an adult male in the summer pelage obtained by Mr. St. George Littledale from the Western Caucasus, and presented by him to the British Museum ; this specimen forming the subject of plate xxi. In this specimen, which from its locality must be referred to the so-called *C. severtzowi*, the horns curve backwards in one plane, are faintly ridged in front in the basal, and strongly knotted in the terminal half ; the interval between the tips being 16 inches. The reddish beard is long and narrow, and occupies only the middle of the chin.

The third specimen is the splendid skull and horns shown in fig. 47, which is in the possession of Mr. Littledale, and was likewise obtained from the Western Caucasus, so that this belongs also to *C. severtzowi*. Now, whereas the length of these horns is just over 40 inches, the interval between their tips is only $15\frac{1}{8}$ inches, or less than that which Dr. Menzbier gives as distinctive of *C. cylindricornis* ! In form these horns are precisely similar to those of the mounted specimen ; their approximation

being solely due to their greater age. Lastly, I have had an opportunity of seeing several mounted heads of various ages in the collection of Prince Demidoff.

Comparing the horns of the two adult males obtained from the Western Caucasus by Mr. Littledale with the figure of the adult male



FIG. 47.—Skull and Horns of male West Caucasian Tur. From a specimen shot by Mr. St. George Littledale.

head from the Central Caucasus figured by Pallas, I can detect no variation except such as is due to difference of age, the beard in the original figure being of the long and narrow type. And since I have shown the alleged wide interval between the tips of its horns to be solely due to immaturity, the so-called *C. severtzowi*, so far as its horns are concerned, is evidently inseparable from *C. caucasica* of Pallas.

With regard to the beard, it is first necessary to show that the

immature specimens in the British Museum from the Central Caucasus, in which the beard is short and wide, are inseparable, so far as their horns are concerned, from the adult males. I have compared the horns of the larger of these immature males, which, as already said, are knotted in front throughout their length, with the tips of those of the adult specimen shown in fig. 47, and have found that the two correspond in every respect. This indicates that the short horns, knotted in front throughout their length, belong to young animals; while long horns with such knotting restricted to the terminal third or half characterise the adult. In respect to the beard, specimens in early winter pelage belonging to Prince Demidoff have this appendage consisting of a broad and short basal fringe extending the whole width of the chin, in the centre of which is a long narrow tuft like that of the adult male in the British Museum. And it accordingly seems that whereas in immature animals the winter beard consists merely of the broad short fringe (fig. 48), in older individuals at the same season the long central tuft is superadded. On the other hand, adult individuals in the summer entirely lose the basal fringe and retain only the long central tuft.

All the alleged points of difference between the so-called *C. severtzowi* and *C. caucasica* being now shown to be inconstant, the evidence for the specific separation of the latter must be regarded as valueless. In this view I am confirmed by Dr. Büchner, who has written to me that, in his opinion, there are but two species of Caucasian tur, namely, *C. cylindricornis* from the eastern, and *C. caucasica* from the western half of the range.

Mr. St. George Littledale has, however, in his possession a skull with horns of a very remarkable type obtained by himself from the neighbourhood of Elbruz, which at first sight might seem to suggest a third form. Although belonging to an adult male, the horns are considerably shorter than those of the typical *C. caucasica*; and in their curvature and the direction of their tips, as well as in the total absence of knots from the

anterior surface, are in some respects intermediate between the former and those of *C. cylindricornis*. It was suggested to their present owner by the natives of the district that they indicated a hybrid between the two well-established species; and I am at present unable to suggest any more probable explanation of the difficulty. That analogous hybrids do now and



FIG. 48.—Head of male West Caucasian Tur. (From Prince Demidoff's *Hunting Trips in the Caucasus*).

again occur naturally is proved by the well-known case of *Ovis brookei* in Zanskar.

The circumstance that these peculiar horns are in some degree intermediate between those of *C. cylindricornis* and the typical *caucasica*, together with the fact that they come from the same locality, suggests that they belong to the same kind of animal as the one to which the latter name is restricted by Dr. Menzbier. It is true that Dr. Menzbier speaks of knots on the front of his specimens, which are wanting in Mr. Littledale's



SPANISH TUR.

example ; but if, as may be possible, a race of hybrids is from time to time developed on the frontiers of the two valid species, such variations would naturally be expected to occur. In any case, it is clear that the specimen under consideration is not the typical *C. caucasica*, and if (probably together with Dr. Menzbier's specimens) it should indicate a new form, such species or sub-species will require a fresh name. I may add that Prince Demidoff, in his *Hunting Trips to the Caucasus*, firmly believes in the existence of hybrids of the above type between the East and the West Caucasian tur.

The following dimensions of horns are recorded by Mr. Rowland Ward :—

Length along Outer Curve.	Basal Circumference.	Tip to Tip.	Locality.
$40\frac{1}{8}$	$12\frac{5}{8}$	$15\frac{1}{4}$	W. Caucasus.
$36\frac{7}{8}$	$11\frac{5}{8}$	$27\frac{5}{8}$	„
$30\frac{5}{8}$	$11\frac{3}{8}$	$16\frac{3}{8}$	Caucasus.
$22\frac{3}{4}$	$10\frac{7}{8}$	$22\frac{1}{4}$	Elbruz.
$19\frac{7}{8}$	$10\frac{5}{8}$	$16\frac{1}{4}$	„

Number four in this list is the abnormal specimen.

Distribution.—The western half of the main chain of the Caucasus, from the neighbourhood of Dych-tau and Elbruz westwards.

In habits this species is probably very similar to the preceding.

3. THE SPANISH TUR—CAPRA PYRENAICA

Capra pyrenaica, Schinz, *Neue Denkschr. schweiz. Ges.* vol. ii. p. 9, pls. ii. and iii. (1838) ; Gray, *Knowsley Menagerie*, p. 33 (1850) ; Blasius, *Säugeth. Deutschlands*, p. 480 (1857) ; Busk, *Trans. Zool. Soc.* vol. x. p. 118 (1877) ; Lydekker, *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 41 (1885) ; P. L. Sclater, *Proc. Zool. Soc.* 1886, p. 315 ; Nathusius, *Zool. Anzeiger*, 1888, p. 333 ; Chapman and Buck, *Wild Spain*, p. 129 (1893) ; Ward, *Records of Big Game*, p. 228 (1896)

Ægoceros pyrenaica, Gray, *Cat. Ungulata Brit. Mus.* p. 147 (1852),
Cat. Ruminants Brit. Mus. p. 52 (1872).

Ibex pyrenaicus, Gervais, *Hist. Nat. Mamm.* vol. ii. p. 188 (1855);
 Graells, *Mem. Ac. Madrid*, vol. xvii. p. 353 (1897).

Ammotragus (?) *pyrenaicus*, Nathusius, *Zool. Anzeiger*, 1888, p. 333.

Plate XXII.

Characters.—Build lighter and face larger and narrower than in either



FIG. 49.—Side view of head of adult male Spanish Tur with the beard fully developed.

of the Caucasian species ; the height at the shoulder reaching to 32 inches. Horns rising close together on the skull ; triangular, with a sharp inner edge, and the front surface irregularly knobbed towards the extremity (where it becomes posterior in position), at base ridged ; the form an open semi-spiral, the direction being at first upwards and outwards, but

afterwards backwards and inwards, frequently with an upward and slightly outward terminal flexure, although, as in the other tur, the tips are generally turned inwards. Beard confined to the chin; long and narrow in old males in the winter pelage (fig. 49); in the summer pelage, and in young males at all seasons, reduced to an insignificant tuft (fig. 50). Summer pelage fine and short; winter dress longer and more shaggy. In the former the general colour dark grayish-brown, with the nape of the neck, a line down the middle of the back, a band on the flanks, and the greater portion of the limbs black or blackish-brown; sides of face brownish-white. In winter the upper-parts light brownish-gray, with the nape of the neck, a line down the back, a broad collar on the chest, the shoulders, flanks, tail, the outer sides of the thighs, and the greater portion of the legs blackish; inner sides of thighs and back of legs whitish. Beard and horns black.

The above description is taken from mounted specimens in the British Museum, one of which is evidently an adult male in the summer dress, while the other, judging from the slight development of the beard and the length of hair on the head and body, seems to be an immature male in the winter pelage. Heads of males with the full winter beard are figured by Messrs. Chapman and Buck in *Wild Spain*.

In the form and character of the horns the Spanish wild goat is clearly intermediate between the tur of the Caucasus and the true ibex, although nearer to the former than to the latter. In its parti-coloured coat the species is, however, more like the Persian wild goat and some of the ibex; but it may best be called a tur rather than an ibex.

The under-mentioned are some of the largest horn-measurements of the Spanish tur given in Mr. Rowland Ward's book:—

Length along Outer Curve.	Basal Circumference.	Tip to Tip.	Locality.
31	$8\frac{3}{4}$	?	Pyrenees
$30\frac{1}{4}$	$9\frac{1}{2}$	?	Spain
$29\frac{3}{4}$	$8\frac{1}{4}$	$23\frac{1}{4}$	Almeira
28	$9\frac{1}{8}$	$23\frac{3}{8}$	Spain
$27\frac{3}{4}$	9	25	„
$27\frac{1}{2}$	$10\frac{3}{8}$	$19\frac{1}{2}$	Pyrenees
$25\frac{5}{8}$	$8\frac{1}{2}$	$16\frac{5}{8}$	Spain
$24\frac{1}{2}$	10	14	Val d'Arras
22	$7\frac{3}{4}$	14	Spain

Habits.—The habits of this tur, the cabra montes of the Spaniards,



FIG. 50.—Side view of Head of male Spanish Tur with the beard reduced to a tuft.
(Rowland Ward, *Records of Big Game*.)

have been well described by Messrs Chapman and Buck in *Wild Spain*, and by Mr. E. N. Buxton in *Short Stalks*, although in one respect there is an apparent discrepancy between the two accounts. Mr. Buxton, for instance, states that the Spanish tur, unlike the ibex of the Alps, takes full advantage of the covert afforded by dense scrub, and suggests that to this habit is due the incurving of the points of the horns which forms such a characteristic feature of the present species. On the other hand, Messrs. Chapman and Buck, in the passage cited under the heading of the Andalusian race, speak of the rams frequenting the highest mountain peaks at elevations of some

10,000 feet. Possibly the apparent discrepancy is due to the different seasons at which the observations were made. According to the generally received account the old rams keep apart from the ewes and younger rams throughout the year, except during the pairing season, which takes place in the month of November. The flocks may be very large, comprising often from 100 to 150 head each. During the spring and summer months, when the old rams are said to be on the highest peaks, the younger members of the same sex and the ewes frequent the warm southern slopes of the mountains. And in winter, under the pressure of cold and hunger, these latter will descend at times even to the near neighbourhood of the higher villages. The kids are born in the latter half of April or the early part of May, after a gestation of about twenty weeks, or perhaps rather more. Very soon after birth they are able to trot after the ewes, which at this season resort to the southern slopes to avoid the cold winds prevailing in other situations.

When among bush-covered country, Mr. Buxton states that it is impossible to bag adult males of this tur without resorting to driving, the hollows in the rocks, and the abundant vegetation by which they are covered, rendering it almost impossible to detect the game with a glass.

a. PYRENEAN RACE—CAPRA PYRENAICA TYPICA

Characters.—Generally those given above, the horns of old males being large and massive, with the ridges tending to disappear. Mr. Busk gives the following description :—“The horns are thick, rounded in front and on the outer side, internally flattened, and behind compressed into an acute angle, whence the transverse section is pyriform. They diverge at first abruptly, and afterwards are twisted spirally inwards and downwards ; so that eventually the inner surface comes to look outwards, and the anterior

inwards and downwards. In the female the horns are short and simply curved, flattened before and behind."

Sir Victor Brooke, in a note to Mr. Abel Chapman, published in the *Badminton Library*, makes the following observations:—"The Pyrenean ibex are much larger beasts than those of the Southern Spanish Sierras. In the Pyrenees they are scarce, and live on the worst precipices I ever saw an animal in; they go into far worse ground than the chamois, and are very nocturnal, never seen except in the dark or early dawn unless disturbed."

Distribution.—The Spanish side of the Pyrenees.

b. ANDALUSIAN RACE—CAPRA PYRENAICA HISPANICA

Capra hispanica, Schimper, *CR. Ac. Paris*, vol. xxvi. p. 318 (1848); Rosenhauer's *Thiere Andalusiens*, p. 4 (1856); Busk, *Trans. Zool. Soc.* vol. x. p. 118 (1877); Chapman and Buck, *Wild Spain*, p. 129 (1893).

Ibex hispanicus, Gervais, *Hist. Nat. Mamm.* vol. ii. p. 189 (1855); Graells, *Mem. Acad. Madrid*, vol. xvii. p. 357 (1897).

Characters.—Very similar to the typical race, from which it is distinguished by its smaller size, and by the horns of old males being thinner and more compressed, with the basal tranverse ridges well developed. The short beard, which has been regarded as distinctive, does not appear to be a character.

Distribution.—The Sierras Nevada and Morena, together with the hill-ranges of Andalusia and Estremadura. Although found throughout the elevated cordillera of Central Spain, this race has its stronghold in the Sierra de Gredos. "This elevated point," write Messrs. Chapman and Buck, "is the apex of the long Carpeto-Vetónico range, which extends from Moncayo through the Castiles and Estremadura, forming the watershed of the Tagus and Douro; it separates the two Castiles, and passing the frontier of Portugal, is there known as the Sierra da Estrella, which (with

the Cintra Hills) extends to the Atlantic seaboard. Along all this extensive cordillera there is no more favourite ground for the ibex than its highest peak, the Plaza de Almanzor, 10,000 feet above sea-level. During the winter and early spring the wild goats have a predilection for the southern slopes towards Estremadura ; but in summer and autumn large herds make their home in the environs of Almanzor, and the lonely Alpine lakes of Gredos."

In the Plistocene epoch this race appears to have extended as far south as Gibraltar ; the goat remains from caverns there described by Mr. Busk being tentatively assigned to the present form.

4. THE COMMON GOAT—CAPRA HIRCUS

Capra hircus, Linn. *Syst. Nat.* ed. 12, vol. i. p. 94 (1766).

Characters.—Generally those of the wild races, as given below, the beard being confined to the chin, and the horns, which are dark olive-brown, or blackish, sweeping backwards in a bold scimitar-like curve, with a sharp front edge, quite unlike the broad and knotted front surface distinctive of those of the true ibex.

The domestic race of this goat is the type of the genus *Capra* as well as of the present species ; and the reasons for the adoption of the name *hircus* for both the domesticated and wild races are the same as those given above under the heading of the common ox.

Distribution.—In a domesticated or feral condition, the greater part of the habitable globe ; in a wild state, as detailed below. Although domesticated, and frequently hornless, breeds are widely spread through Africa, I am not aware of the existence of any feral race in that continent, although such may occur on its northern confines.

a. PERSIAN WILD RACE, OR PASANG—CAPRA HIRCUS ÆGAGRUS

Capra ægagrus, Gmelin, *Syst. Nat.* vol. i. p. 193 (1788); Desmarest, *Mammalogie*, vol. ii. p. 483 (1822); Hutton, *Calcutta Journ. Nat. Hist.* vol. ii. p. 521, pl. xix. (1842), *Journ. As. Soc. Bengal*, vol. xv. p. 161 (1846); Blasius, *Säugeth. Deutschlands*, p. 485 (1857); P. L. Sclater, *Proc. Zool. Soc.* 1874, p. 89, 1886, p. 315, pl. xxi.; Blanford, *Proc. Zool. Soc.* 1874, p. 248, *Journ. As. Soc. Bengal*, vol. xlv. p. 15 (1875), *Eastern Persia*, vol. ii. p. 89 (1876), *Fauna Brit. Ind.—Mamm.* p. 502 (1891); Danford, *Proc. Zool. Soc.* 1875, p. 458; Danford and Alston, *Proc. Zool. Soc.* 1877, p. 276; Sterndale, *Mamm. India*, p. 486 (1884); Radde, *Proc. Zool. Soc.* 1887, p. 552; W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 142 (1891); Satunin, *Zool. Jahrb. Syst.* vol. ix. p. 311 (1896); Ward, *Records of Big Game*, p. 229 (1896).

Antilope gazella, Gmelin, *Syst. Nat.* vol. i. p. 190 (1788), *nec Capra gazella*, Linn. 1796.

Ægoceros ægagrus, Pallas, *Zool. Rosso-Asiat.* vol. i. p. 266 (1811); Kotschy, *Verh. Ver. Wien*, vol. iv. p. 201 (1854).

Capra caucasica, Gray, *List Mamm. Brit. Mus.* p. 167 (1843), *nec* Pallas, 1783; Adams, *Proc. Zool. Soc.* 1858, p. 525.

Ægoceros pictus, Erhardt, *Fauna Cycladen*, p. 29 (1858).

Capra picta, P. L. Sclater, *Proc. Zool. Soc.* 1874², p. 689, pl. lviii.

Hircus gazella, Gray, *Cat. Ruminants Brit. Mus.* p. 53 (1872).

Capra hircus, var. *ægagrus*, Flower and Garson, *Cat. Osteol. Mus. Coll. Surg.* pt. ii. p. 251 (1884).

Plate XXIII.

Characters.—Build relatively slender; height at shoulder reaching to 37 inches. Horns of male scimitar-shaped, curving backwards, much

compressed, with the inner front edge (which is the only one developed) sharp, keeled for some distance above the base, and above this bearing several bold widely-separated knobs ; on the inside nearly flat, externally convex, behind rounded ; tips generally convergent, but occasionally divergent ; throughout faintly striated ; in colour nearly black. Beard of male restricted to the chin, very long, and in old males occupying the whole width of the chin, but in younger animals only the middle ; together with the hair on the neck and shoulders, longest in winter, at which season a soft under-fur is developed in the colder parts of the animal's habitat. General ground-colour of upper-parts brownish-gray in winter, reddish-brown in summer, becoming paler in old males ; under-parts and inner sides of buttocks and thighs white or whitish ; in adult and subadult males the face, a broad streak from the nape of the neck to the root of the tail, the entire tail, a collar on the neck, expanding to form a breast-plate below, the throat, chin, beard, the front of the limbs, except the knees, and a stripe along the flanks separating the brown of the back from the white of the under-parts and joining the dark streak on the front of the thighs, dark blackish-brown, becoming in some cases nearly black on the beard, face, and some other parts ; knee (carpus), the hinder and inner surface of the fore-leg below this, the hock (tarsus), and the inner and hinder surface of the hind-leg below the same, white or whitish.

Some amount of individual variation is displayed in regard to the extent of the black and white markings. Of several mounted specimens in the British Museum, two old males, the one from Erzerum and the other from Mount Ararat, are of very large size, and have the beard extending the whole width of the chin. On the other hand, in a pair of males from the Cilician Taurus the size is considerably less, and the beard occupies only the middle of the chin. It is doubtful if these differences are due to anything more than disparity of age. The difference

in the size of the beard does not appear due to season, since one of the larger males seems to be in the winter and the other in the summer dress. An immature male from the Caucasus living in the London Zoological Gardens in 1898 presented no appreciable points of difference from the *Taurus* examples.

In the female the horns are much smaller and placed farther apart, rising for some distance erect, and then curving slightly backwards; their transverse section being oval. The beard is wanting, and the coloration paler than in the male.

Mr. Rowland Ward records the following horn-measurements of this and the next race of the wild goat:—

Length along Outer Curve.	Basal Circumference.	Tip to Tip.	Locality.
$52\frac{3}{8}$	$7\frac{7}{8}$	$8\frac{3}{4}$	Sind
$48\frac{1}{2}$	$8\frac{3}{8}$	$13\frac{7}{8}$	Caucasus
$46\frac{3}{4}$	7	14	Sind
$46\frac{1}{2}$	$8\frac{7}{8}$	$18\frac{7}{8}$	Asia Minor
46	$7\frac{5}{8}$	11	Sind
$45\frac{1}{4}$	8	$11\frac{1}{4}$	„
$44\frac{1}{2}$	$8\frac{7}{8}$	$21\frac{3}{8}$	Caucasus
$44\frac{1}{2}$	$8\frac{5}{8}$	11	(?) Sind
43	$8\frac{1}{8}$	$22\frac{3}{8}$	?
$43\frac{3}{8}$	$8\frac{3}{8}$	$14\frac{5}{8}$	?
43	9	$15\frac{3}{4}$	Taurus Mountains
43	$9\frac{1}{2}$	?	Asia Minor

In the *Asian* newspaper of 2nd August 1898, Mr. J. Strip, of the Customs Department in Sind, gives the following account of a living specimen whose horns are reported to exceed all the foregoing in length. The animal was seen at Karachi on board ship, in charge of an agent of Mr. C. Hagenbeck, and had been obtained from Luristan, in Persia. “My measurement,” writes Mr. Strip, “with the aid of Mr. Judd and the owner, who helped me in holding the animal and placing the tape

carefully over the curve, showed the left horn to be $55\frac{1}{2}$ inches, and the right, which was broken, $50\frac{1}{2}$ inches, and between the tips 24 inches."

Distribution.—The islands of South-Eastern Europe (from most of which it is now exterminated), and the mountains of South-Eastern Europe and South-Western Asia, from the Caucasus through Persia to the confines of Baluchistan, where it probably intergrades with the Sind race. Although exterminated in the islands of the Grecian Archipelago, where it was formerly abundant, the wild goat is stated by Dr. Forsyth Major still to survive in the island of Tavolara, situated off the north-east coast of Sardinia, where its fossilised remains also occur. According to Dr. Radde, in the Caucasus this species is found in the Little Caucasus, or Armenian Highlands, from the sea-level to heights of 12,000 feet, and on Mount Ararat up to 14,000 feet. He also records it from the Upper Ardon, Western Daghestan, forming the western extremity of the Great Caucasus.

Habits.—In Asia Minor, according to Mr. C. G. Danford, the wild goat is found either solitary or in small parties or herds varying in number from ten to twenty up to as many as one hundred head. During summer the old bucks keep to the higher mountains, being often met with on the snow, while the does and kids frequent lower elevations. In winter both sexes keep much more together, living at elevations of from 2000 to 3000 feet on rocky ground among bushes or scattered pines. In certain districts they may even descend almost to the sea-level. Although at other times extremely shy and wary, during the pairing season they can be approached with ease, and may be attracted within range by a concealed hunter rolling a few stones down the hillside. If surprised, they utter a kind of short snort, and immediately make off in a canter. Their agility among rocks is little short of marvellous, but if driven down to the lowlands they can be easily caught by dogs, as is done in Afghanistan. When danger threatens, the oldest male takes command of the herd, and carefully surveys the line of advance or retreat before permitting the others to follow. Grass, the

young shoots of dwarf oaks and cedars, and berries constitute their staple food in these districts. The kids, which are usually either one or two in number, are born in May.

b. SIND WILD RACE—CAPRA HIRCUS BLYTHI

Capra blythi, Hume, *Proc. As. Soc. Bengal*, 1874, p. 240, no description.

Characters.—Size smaller than in the Persian race; the front edge of the horns of the males either totally devoid of knots, or with only a very few and these very small; and the ground-colour of the pelage very much paler, but the face-markings darker and more sharply defined. From the table on p. 262 it will be seen that, length for length, the Sind race has the tips of the horns closer together than in specimens from other districts.

The name *C. blythi* was applied by Mr. Hume to the Sind wild goat in order to distinguish it from *C. caucasica*, with which it had been confounded, but as no description was given, the name must date from the present use. A skull and horns presented by Mr. Hume to the British Museum (No. 91, 8, 7, 160) may be taken as the type, their place of origin being Sind.

Distribution.—Sind and Baluchistan; in the eastern districts of the latter country probably intergrading with the Persian race.

c. DOMESTICATED BREEDS—CAPRA HIRCUS TYPICA

Ægoceros hircus, Pallas, *Zoogr. Rosso-Asiat.* vol. i. p. 227 (1811).

Hircus ægagrus, Gray, *Cat. Ungulata Brit. Mus.* p. 152 (1852), nec *Capra ægagrus*, Gmelin, 1788.

Capra dorcas, Reichenow, *Zool. Jahrb. Syst.* vol. iii. p. 591, pl. xv. (1888), *Zool. Garten*, vol. xxix. p. 29 (1888).

The domesticated goat of Sweden, which is the typical representative of the species, is certainly the descendant of the wild *ægagrus*, as are also

probably most other domesticated breeds, whether still kept in captivity or reverted to the wild state, as they have in many countries and islands. To describe any of these breeds would be beyond the province of this work, as they do not come under the title of wild animals, in the proper sense of the word. Many of them have received distinct technical names, although none are entitled to rank as separate species, or even sub-species. The goat of the Island of Joura, near Eubœa, has been regarded as truly wild and described as *C. dorcas*, but I am informed by Prof. E. Büchner, who has seen living specimens in Berlin, that it is nothing more than a domesticated breed run wild. A distinction between most, if not all, domesticated goats and the wild races is to be found in the presence of a beard on the chins of the females of the former, but this is evidently an acquired character. Although, as already mentioned, at least the majority of the domesticated breeds trace their ancestry to the wild *ægagrus* and *blythi*, many appear to have been crossed with other wild species, such as ibex and markhor, both of which will readily breed in confinement with tame goats. In the Himalaya and Tibet it is by no means uncommon to meet with domesticated goats having spiral horns of the markhor type, and it is not impossible that some of the breeds with such horns may be descended from the markhor. As a rule, however, the spiral in tame goats runs in the reverse direction to that obtaining in the markhor, the first turn of the front ridge of the horns inclining inwards. But Mr. Blanford states that he has seen exceptions, one being a Nepalese head in the British Museum.

It may be added that the Kashmir shawl-goat develops a considerable amount of under-fur, or pashm, at the base of the longer hairs, which is the material employed in weaving. Since similar pashm occurs in the wild goat, and is wanting in the markhor, an additional argument is presented in favour of the origin of the domesticated breeds from the former species. Mr. Schreiner, the author of an interesting little volume on

The Angora Goat,¹ is of opinion that the long silky hair of that breed—the mohair of commerce—represents an excessive development of the pashm of the Kashmir and wild goats, the so-called “kemp” of the Angora being the remnant of the ordinary hair of the original outer coat of the former.

5. THE ARABIAN IBEX—CAPRA NUBIANA

Capra nubiana, F. Cuvier, *Hist. Nat. Mamm.* fasc. vii. pl. 397 (1825); Gray, *Knowsley Menagerie*, p. 32 (1850), *Cat. Ungulata Brit. Mus.* p. 151 (1852), *Cat. Ruminants Brit. Mus.* p. 53 (1872); Ward, *Records of Big Game*, p. 230 (1896); Pousargues, *Ann. Sci. Nat. Zool.* vol. iv. p. 85 (1897).

Capra sinaitica, Hemprich and Ehrenberg, *Symb. Phys. Zool.* vol. i. pl. xviii. (1828); P. L. Sclater, *Proc. Zool. Soc.* 1886, p. 316, pl. xxxii.; W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 144 (1891); Ward, *Records of Big Game*, p. 229 (1896).

Capra arabica, Rüppell, *Neue Wirbelth. Abyssin.* p. 17 (1835); Flower and Garson, *Cat. Osteol. Mus. Coll. Surg.* pt. ii. p. 249 (1884).

Ægoceros beden, Wagner, Schreber's *Säugethiere*, vol. v. p. 1303 (1836).

Capra beden, Blasius, *Säugeth. Deutschlands*, p. 482 (1857); Tristram, *Proc. Zool. Soc.* 1866, p. 85, *Fauna Palestine*, p. 6, pl. ii. (1884).

Capra mengesi, Noack, *Zool. Anzeiger*, 1896, p. 353; see P. L. Sclater, *Proc. Zool. Soc.* 1897, p. 900.

Characters.—Build moderately stout; height at shoulder about 33 inches. Horns scimitar-like, very long, slender, and highly curved; the outer front angle bevelled off and the front surface relatively narrow, with a large number of rather closely approximated transverse knot-like ridges of somewhat large size. Ears relatively long, margined with white. Beard long, pointed, and occupying the full width of the chin. A little longish hair below

¹ London, 1898, 8vo.

the middle of the nape of the neck, and the hair on the middle line of the back also somewhat elongated, elsewhere the pelage short and close. General colour of upper-parts brownish or yellowish-fawn, probably varying



FIG. 51.—Head of male Arabian Ibex from Hadramut, South-Eastern Arabia.
(From Sclater, *Proceedings Zool. Soc.* 1897, p. 900.)

somewhat according to the season of the year ; muzzle, chin, beard, flanks, chest, nape-tuft, dorsal line, sides of tail, and outer side and front of legs (except knees and pasterns) blackish-brown or black ; inner sides of thighs and buttocks, a streak on the abdomen, the inner sides and back of hind-legs below the hocks, most of the corresponding surfaces of the fore-legs,

the knees, and a band above each hoof, white or whitish; horns blackish.

The most distinctive features of this species are the length and narrow front surface of the horns, and the long beard. In the former respect the animal stands in some degree intermediate between the wild goat and the Asiatic ibex, being broadly distinguished from the European ibex by the much greater length of the beard.

Mr. Rowland Ward records the following dimensions of horns of this goat :—

Length along Outer Curve.	Basal Circumference.	Tip to Tip.	Locality.
50	9	?	North Africa
$46\frac{1}{2}$	8	?	South Arabia
$42\frac{1}{4}$	$9\frac{1}{4}$	$15\frac{1}{4}$	North-West of Suakin
$41\frac{3}{4}$	$7\frac{5}{8}$	$17\frac{5}{8}$	North Africa
$38\frac{7}{8}$	$7\frac{1}{2}$	$12\frac{1}{2}$	Upper Egypt
$38\frac{1}{2}$	$7\frac{1}{2}$	$27\frac{1}{4}$	Suakin
$38\frac{1}{4}$	8	21	„
$35\frac{1}{4}$	7	$15\frac{3}{8}$	Sinaitic Peninsula
$35\frac{1}{8}$	$7\frac{1}{8}$	12	North-West of Suakin
$31\frac{3}{8}$	$6\frac{1}{2}$	$13\frac{1}{2}$	Sinaitic Peninsula
$31\frac{3}{8}$	8	$13\frac{1}{4}$	Arabia
$20\frac{1}{4}$	5	$8\frac{3}{4}$	Sinaitic Peninsula

This and the three following species may properly be recognised as ibex, although that name is often also applied to the Spanish tur. They are all characterised by the scimitar-shaped horns, of which the front surface is more or less broad and carries a series of knot-like widely-separated transverse ridges. In the relative narrowness of this front surface the present species approximates, however, to the wild goat; and all the members of the genus are so closely connected that, as already mentioned, it appears impossible to divide them into sub-generic groups distinguished by well-marked and sharply-defined characters.

Distribution.—The mountains of Southern Arabia, Palestine, the Sinaitic Peninsula, Upper Egypt, and thence apparently into those of Morocco and the interior of Senegambia. The type specimen is a pair of horns preserved in the Museum at Paris. In the same collection are two other pairs stated to have been obtained from Senegal. With regard to these latter, Mons. Pousargues considers that we should await further evidence before definitely adding North-Western Africa to the distributional area of the species. Additional evidence in favour of such western extension is afforded by a small but characteristic pair of horns in the possession of Dr. Guillemard, which was obtained by him some years ago at Tangier, where it was stated by the former owner to have come from the Atlas. It was scarcely likely to have been exported from Egypt to Tangier; and, taken together with the Paris specimens, seems to indicate that the species is really an inhabitant of the little known mountainous districts of the interior of North-Western Africa.

Habits.—The general mode of life of the Arabian ibex is probably very similar to that of the European and Asiatic species. In Arabia Petræa the animal is stated by Canon Tristram to be very common, while even in Palestine it is less rare than is often supposed. Like other ibex, they are very shy and wary, keeping to the upper regions of the mountains, where their colour renders them very difficult to distinguish from the rocks among which they dwell. An observer, quoted by Canon Tristram, states that the kids, before they are able to accompany the old ones, are concealed by the mother under some rock, and apparently are only visited at night. He once caught a young one which ran from under a rock as he was climbing a mountain. The little creature had evidently heard the intruder approaching, and ran out under the impression that he was its mother.

6. THE ABYSSINIAN IBEX—CAPRA VALI

Capra walia, Rüppell, *Neue Wirbelthiere Abyssin.*—*Säugeth.* vol. i. p. 16, pl. vi. (1835); P. L. Sclater, *Proc. Zool. Soc.* 1886, p. 316.

Capra valie, Sundevall, *K. Svenska Vet. Akad. Handl.* for 1844, p. 95 (1846); Gray, *Knowsley Menagerie*, p. 32 (1850), *Cat. Ungulata Brit. Mus.* p. 152 (1852).

Capra wali, Richters, *Big Game Shooting* (Badminton Library), vol. ii. p. 325 (1894).

Characters.—Distinguished from the other species of ibex by the presence of a bony prominence on the forehead; the horns being of the general type of those of *C. sibirica*, but the beard small and rudimentary, as in the Alpine species.

Dr. Richters, of the Frankfort Museum, as quoted by Col. Percy in the volumes of the *Badminton Library* on big game shooting, writes as follows of this ibex:—"The horns of *Capra wali* differ from those of *C. sibirica* in the following points; the outer surface in *wali* is curved, while in *sibirica* it is corrugated; the under side in *wali* being sharper than in *sibirica*. The inner side in *wali* has between every two knobs (on the top of the horn) five or six grooves, which correspond with a similar number of notches of equal depth on the under side. *C. sibirica*, on the other hand, has a fairly smooth inner surface, and on the under side has under every two knobs (on the top of the horn) a deep notch, and between every two deep notches a shallower one. The tip of *sibirica* is more curved than that of *wali*. The horn of our specimen of *wali* has eight knobs on it, that of *sibirica* (horns $36\frac{1}{4}$ inches in length, girth or base $9\frac{1}{2}$ inches, cord from base to tip 22 inches) 17 knobs."

This species, which is represented only by specimens preserved in the

Senckenberg Museum at Frankfort, is known to me solely from Rüppell's description and figure and the above notes.

Distribution.—The high mountain ranges of Abyssinia.

7. THE ALPINE IBEX—CAPRA IBEX

Capra ibex, Linn. *Syst. Nat.* ed. 12, vol. i. p. 95 (1766); Desmarest, *Mammalogie*, vol. ii. p. 480 (1822); H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 300, v. p. 357 (1827); Gray, *List Mamm. Brit. Mus.* p. 167 (1843), *Knowsley Menagerie*, p. 32 (1850), *Cat. Ungulata Brit. Mus.* p. 142 (1852), *Cat. Ruminants Brit. Mus.* p. 52 (1872); Blasius, *Säugeth. Deutschlands*, p. 475 (1857); P. L. Sclater, *Proc. Zool. Soc.* 1886, p. 315; Reichenau, *N. Jahrb. Min.* 1896, vol. i. p. 221; Ward, *Records of Big Game*, p. 227 (1896).

Capra alpina, Girtanner, *Journ. Physique*, vol. xxviii. p. 224 (1786).

Ægoceros ibex, Pallas, *Zoogr. Rosso-Asiat.* vol. i. p. 224 (1811), in part.

Ibex alpinus, Gray, *List Osteol. Brit. Mus.* p. 59 (1847); Nehring, *Tundren und Steppen*, p. 206 (1890).

Ibex europæa, Hodgson, *Journ. As. Soc. Bengal*, vol. xvi. p. 700 (1847).

Characters.—Size and build generally similar to that of the Arabian ibex, the height at the shoulder reaching to about 40 inches. Ears relatively small; beard of males, which is confined to the chin, short and small. Horns of male long, scimitar-shaped, sweeping backwards in the usual curve; their front surface wide, with a slight bevelling of the outer angle, the transverse knots more or less strongly developed, but usually thinner than in the next species, with their outer portion sloping away towards the margin of the front surface of the horn. Horns of females small and upright, the usual length being from 6 to 8 inches. Pelage coarse and thick, but varying according to the season; in summer shorter, finer, and more shining; in winter longer, rougher, and duller, with a

short thick under-fur ; at all seasons longer on the back of the neck, where it forms a kind of short mane in the old bucks. In summer the general colour of the upper-parts reddish-gray, in winter yellowish-gray ; under-parts paler, and separated from the dark of the back by a chocolate-brown streak ; a light brown stripe down the middle of the back ; forehead, cheeks, nose, throat, beard, upper surface of tail, and the lower portion of the legs dark brown ; on the chin, in front of the eyes, beneath the ears the colour tending to rusty ; ears fawn-brown externally, whitish internally ; hinder part of abdomen nearly white. With advancing age the coloration tends to become more and more uniform. Horns yellowish or olive-brown.

At the present day it is difficult to be certain that specimens of the ibex have not some intermixture of the common goat in their pedigree ; and it is probable that to such crossings are due certain deviations from the coloration described. For example, a mounted specimen purchased by the British Museum in 1897 shows a whitish ring round each eye, and a spot of the same colour on each side of the upper jaw behind the lip, and another on the lower jaw ; the middle portion of the hinder surface of the cannon-bones has also whitish hair, as in the Himalayan race of the Asiatic ibex. In other specimens in the Museum, procured many years ago, these light markings are wanting, and they are accordingly regarded as aberrant.

The distinctive features of this species, to which the names ibex and steinbok are properly restricted, appear to be the broad front surface of the horns and the small size of the beard of the males, together with the relatively short ears. All three features readily serve to differentiate the species from the Arabian ibex ; while the shortness of the beard distinguishes it from the Asiatic species, to which, however, it is much more closely allied. The horns are, indeed, very difficult to distinguish from those of the latter ; but they never appear to attain such large dimensions ;

and, so far as my own observations go, they show a distinct tendency to bevelling of the outer angle of the front surface, while the transverse knots are generally thinner and tend to have the outer half less developed than the inner portion.

Mr. Rowland Ward gives the following measurements of horns of the Alpine ibex :—

Length along Front Curve.	Basal Circumference.	Tip to Tip.	Locality.
$35\frac{3}{8}$	9	$26\frac{3}{4}$	Aosta
$34\frac{1}{2}$	$9\frac{3}{4}$	?	Styria
$34\frac{1}{4}$	9	26	Aosta
$33\frac{1}{8}$	9	$39\frac{3}{8}$	„
$31\frac{3}{4}$	$9\frac{1}{8}$	$18\frac{3}{8}$	Savoy
$30\frac{1}{3}$	$9\frac{3}{4}$	$29\frac{3}{4}$	Aosta
30	9	21	?
$26\frac{3}{4}$	$8\frac{3}{8}$	$22\frac{1}{8}$	Aosta
$21\frac{1}{2}$	$8\frac{5}{8}$	$14\frac{7}{8}$	„

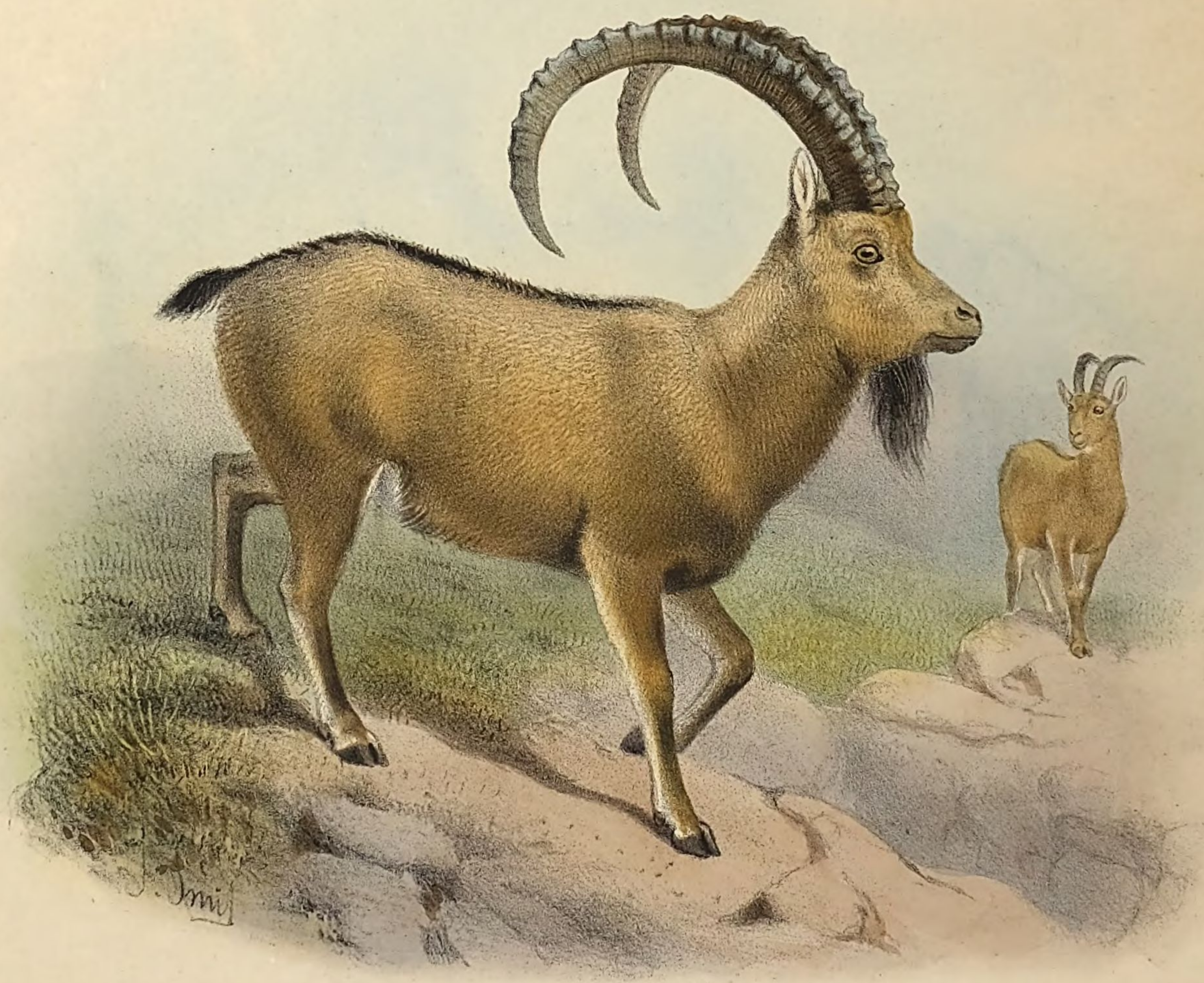
In former days it is not improbable that somewhat longer specimens might have been obtained, and Brehm gives the maximum known length as about 40 inches.

Distribution.—The Alps of Switzerland, Savoy, and the Tyrol, where the species is now practically exterminated, although small herds are preserved in a few valleys on the Italian side of Monte Rosa. The extermination of the ibex, or steinbok, as it is called in the German-speaking cantons, appears to have been brought about at a very early date. Even in the sixteenth century it seems to have become very rare and local. In the valley of Martinswand the last individual is stated to have been killed in the year 1540,¹ while from the canton Glarus it was exterminated in 1550, and in 1574 it was difficult to find a buck in Graubünden. At the commencement of the seventeenth century it had become very scarce in Bergell and the Upper Engadine, where in 1612 its destruction

¹ Klar, *Zeitschrift der Ferdinandeums für Tirol, etc.* ser. 3, vol. xli. p. 302 (1897).

was prohibited under a fine of fifty gold crowns, and twenty-one years later by a still heavier penalty. At the close of the seventeenth century it was still found in the mountains around Bagnethal, and at the commencement of the eighteenth century in Wallis, since which date it has completely disappeared from Switzerland. Its date of extermination from one of the valleys of the Tyrol has been already mentioned; in the year 1666 a few head still survived in the Zillerthal. In 1694 there were known to be 72 bucks, 83 does, and 24 fawns living in the Tyrol; but by 1706 the number had diminished to 5 bucks and 7 does, since which date none have been seen. On the Piedmontese side of Monte Rosa, thanks to Government protection, the ibex has been more fortunate, and, as already said, herds exist in several valleys, although it is doubtful whether all these are pure bred. In 1865 Tschudi reported them to be comparatively numerous, since which date several fine specimens have, by special permission, been shot. In earlier days ibex must have been very abundant, since it is stated that between one and two hundred head were on more than a single occasion exhibited alive in the Roman amphitheatre.

In Prehistoric and Plistocene times the distribution of the animal was much more extensive than at a later date. A horn has been found in one of the Swiss pile-villages, but this, of course, might have been brought from the mountains by some early hunter. Heer, in his *Ancient Switzerland*, states that horn-cores have been found in the gravel of Oberried in the Rhine valley, and a skull in a glacial moraine at Pontegana. And Nehring also mentions the occurrence of similar remains here and there in the superficial deposits of various districts in Central and Western Europe. He is, however, of opinion that the ibex remains discovered in Bohemia belong to the Asiatic rather than to the European species. Heer likewise states that fossilised ibex bones have been obtained from many parts of Italy, even as far south as Naples. And it may accordingly be considered



ASIATIC (THIAN SHAN) IBEX.

certain that the animal was formerly able to exist at comparatively low elevations, and that its restriction to the high Alps is a relatively modern event in its history.

Habits.—In the days of its abundance the Alpine ibex was probably so similar in its general mode of life to the Asiatic species that one account will in the main serve for both. There is, however, some difference between the two in respect to the times of reproduction. In the Alpine ibex the pairing time is January, and the kids are born five months later, about the end of June or beginning of July. Either one or two kids are produced at a birth, and in size they are nearly the same as those of the ordinary domesticated goat. In the Alps the old buck ibex, which keep apart from the does at all times except the pairing season, ascend far above the snow-line, and are thus denizens of a region to which the chamois does not properly belong. The cry or bleat of the ibex is very similar to that of the chamois, but more prolonged.

8. THE ASIATIC IBEX—CAPRA SIBIRICA

Capra sibirica, Meyer, *Zool. Annal.* vol. i. p. 397 (1794); Gray, *List Mamm. Brit. Mus.* p. 52 (1843), *Cat. Ungulata Brit. Mus.* p. 150 (1852), *Cat. Ruminants Brit. Mus.* p. 52 (1872); Blasius, *Säugeth. Deutschlands*, p. 481 (1851); Radde, *Reise Ost-Siberien*, vol. i. p. 243, pl. x. (1862); Severtzoff, *Ann. Mag. Nat. Hist.* ser. 4, vol. xviii. p. 333 (1878); Blanford, *Scient. Results Second Yarkand Exped.—Mamm.* p. 86 (1879); *Fauna Brit. Ind.—Mamm.* p. 503 (1891); Scully, *Proc. Zool. Soc.* 1881, p. 208; P. L. Sclater, *Proc. Zool. Soc.* 1886, p. 316; Prezewalski, *Cat. Zool. Coll.* p. 15 (1887); W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 143 (1891); True, *Proc. U. S. Mus.* vol. xvii. p. 6 (1894); Ward, *Records of Big Game*, p. 224 (1896).

Ægoceros ibex, Pallas, *Zoogr. Rosso-Asiat.* vol. i. p. 224 (1811), in part.

Capra pallasii, Schinz, *Neue Denkschr. schweiz. Ges.* vol. ii. p. 9 (1838), nec *Ægoceros pallasii*, Rouillier, 1841, vide *Proc. Zool. Soc.* 1887, p. 553.

Ibex sibirica, Hodgson, *Journ. As. Soc. Bengal*, vol. xvi. p. 700 (1847).

Ibex sibiricus, Nehring, *Tundren und Steppen*, p. 111 (1890).



FIG. 52.—Oblique view of Head of male Himalayan Ibex. (From Darrah's *Sport in the Highlands of Kashmir*.)

Plate XXIV.

Characters.—Height at shoulder reaching to from 40 to 42 inches. Build and general appearance very similar to the Arabian ibex, the beard of the males, which is confined to the chin, being long and pointed, the ears relatively large, and the horns scimitar-shaped and very long. The front surface of the latter very broad, with no bevelling of the outer edge, and bearing very prominent and thick transverse knots, of which the outer

side is almost as much developed as the inner ; the section completely triangular, with the hinder angle compressed. Horns of female much smaller, placed wider apart on the head, coarsely rugose, or ringed, with an oval section at the base, but compressed above, and inclining slightly backwards. Hair coarse and brittle, forming a rather elongated ridge along the back in the male, and in winter underlain by a dense, soft, woolly underfur or pashm. General colour of upper-parts in summer some shade of brown, becoming chocolate in old males, with a more or less distinctly defined dirty white saddle on the middle of the back, scarcely paler on the under-parts ; in late winter the general colour yellowish-white, more or less tinged with brownish or grayish, but in the early part of the season old males much darker, being frequently full brown with a large, dirty white saddle-shaped patch on the back ; generally a dark line down the middle of the back at all seasons ; beard and tail dark brown at certain times of year, as are the legs, which may or may not have a large white streak on the hinder surface of both cannon-bones. Horns yellowish- or olive-brown.

There is no difficulty in distinguishing the horns of this species, the finest of the group, from those of the Arabian ibex. They attain much larger dimensions than those of any examples of the Alpine species now extant ; and it is probable that the latter, even in its prime, never attained similar dimensions. Alpine ibex horns, judging from such examples as have come under my own notice, seem always distinguishable by the slight, although distinct, bevelling of the outer external angle ; and by the transverse knots being either altogether smaller, or by having a less development of their outer portion. The smaller ears and slight development of the beard are also distinctive differences in the Alpine species.

The following are some of the largest dimensions of the horns of this species recorded by Mr. Rowland Ward :—

Length along Front Curve.	Basal Circumference.	Tip to Tip.	Locality.
$54\frac{3}{8}$	$10\frac{1}{4}$	25	Gilgit
$53\frac{1}{4}$	$10\frac{1}{2}$	$20\frac{1}{4}$	"
$51\frac{1}{2}$	?	?	Kashmir
$51\frac{1}{4}$	$10\frac{1}{2}$	16	?
51	$9\frac{1}{8}$	$28\frac{1}{2}$	?
50	$10\frac{1}{4}$	21	?
50	11	$30\frac{1}{2}$	?
$49\frac{3}{4}$	$10\frac{3}{8}$	$25\frac{1}{4}$	?
$49\frac{1}{2}$	$10\frac{1}{8}$	42	Kashmir
49	$10\frac{1}{4}$	$9\frac{1}{2}$	Baltistan
$48\frac{1}{2}$	$9\frac{5}{8}$	$30\frac{1}{2}$	?
$48\frac{1}{2}$	$9\frac{3}{4}$	$34\frac{1}{2}$	Gilgit
$47\frac{1}{2}$	$10\frac{1}{4}$	20	?
47	$10\frac{1}{2}$	$29\frac{3}{4}$	Kashmir
$46\frac{1}{2}$	11	$24\frac{3}{4}$	"
46	$9\frac{3}{4}$	25	?
$45\frac{1}{4}$	$9\frac{5}{8}$	$24\frac{3}{4}$	Baltistan
45	$10\frac{1}{2}$	26	Astor
45	$10\frac{1}{2}$	29	Ladak
$44\frac{5}{8}$	$10\frac{3}{4}$	30	?
$44\frac{1}{2}$	$11\frac{3}{4}$	26	?
$44\frac{1}{2}$	11	19	?
$44\frac{1}{4}$	10	34	Ladak
$43\frac{3}{4}$	$9\frac{1}{2}$	$16\frac{1}{2}$	Kashmir
$43\frac{5}{8}$	$10\frac{1}{4}$	$24\frac{3}{4}$	?
$43\frac{1}{2}$	$9\frac{3}{4}$	19	Himalaya
$43\frac{1}{2}$	$9\frac{3}{4}$	$18\frac{3}{4}$	Kashmir

Female horns generally measure about 12 inches in length.

Mr. Blanford, who derived his information from General Kinloch, gives the height at the shoulder at about 40 inches ; but Mr. Rowland Ward records measurements ranging from 40 to 42 inches. The specimens in the British Museum, as mounted, stand about 38 inches, but the skins of these have probably shrunk.

Distribution.—The mountain ranges of Central Asia, from the Altai to the Himalaya, and from the neighbourhood of Herat to Kumaun ; in

Kashmir unknown in the Pir-Panjal, and, I believe, the Kajnag ranges ; in Central Asia, ranging as far east as Lake Baikal, and in the Himalaya at least as far as the source of the Ganges.

Habits.—For the last forty or fifty years the Himalayan race of this handsome species has formed such a favourite object of pursuit to English sportsmen that naturalists, from their writings, have become thoroughly



FIG. 53.—Front view of head of male Himalayan Ibex. (From Darrah's *Sport in the Highlands of Kashmir*.)

acquainted with its life history. The usual result of such pursuit is, however, making itself severely felt in the neighbourhood of the Kashmir valley, even if not also in districts still more remote. And whereas Colonel F. Markham, whose *Shooting in the Himalayas* was published in the year 1854, speaks of herds of ibex numbering a hundred or more individuals, very much smaller parties are now the rule. The thick coat of pashm, or under-fur at the base of the longer hairs of the coat renders the kel, as this ibex is called in Kashmiri, practically independent of cold, and there-

fore a hardier animal than its longer-coated relative the markhor. And it is stated that, as a rule, even in winter they do not descend to very low levels, although I have seen a flock driven down by a sudden blizzard to the level of the Indus valley in Ladak during summer, and the villagers of Tilel and Maru-Wardwan report killing them at no great height above their habitations during the depth of winter. When they keep at considerable elevations during the long winter season they are stated to select positions where the steepness of the ground prevents heavy accumulations of snow, and where consequently a precarious subsistence is to be picked up at all seasons. About October the old males descend from the high uplands where they have spent the summer to consort with the females; the pairing season taking place in winter, and the young are born during May and June. Previous to the latter event the males have once more separated themselves to seek the mountain peaks. When on these elevations they often spend the day in slumber far above the limits of vegetation among wastes of snow and ice, descending regularly every morning and evening to graze on the Alpine pastures at lower levels. Such descents are the sportsman's opportunity; and the most wearying thing about ibex-shooting is the long midday wait when the game are reposing on the almost inaccessible crags. In spite of their excessive wariness, ibex are not excessively difficult to approach on account of the broken and rugged nature of the ground they frequent, which affords abundant means of concealment for the stalker. To protect themselves they rely both upon sight and smell, although it has been stated that the former sense is considerably the more acute of the two.

Their chief natural enemies are the wild dog and the snow-leopard, or ounce, and since these probably in most cases approach them from below, it is to that direction their vigilance is directed, as they either have no fear of avalanches, or are sufficiently warned by the noise these make in descending. Accordingly, the object of the sportsman should be to get

well above his game, from which point of vantage he may stalk them with comparative ease. Where ibex are much harassed they acquire the habit of posting two or three of their number to act as sentinels, while the rest of the herd are grazing ; the alarm-signal being a loud kind of whistle, on hearing which the whole company immediately take to flight. And there are few finer sights than to see a herd of male ibex making their way at headlong speed across apparently impassable crags, glaciers, and gorges. When in flight they invariably make for higher grounds.

In parts of the Himalaya ibex are hunted by the natives with dogs, and where they have been thus harried, or after they have been pursued by packs of wild dogs, they are almost impossible to approach. They are, however, by no means always scared by the sound of shooting in their neighbourhood ; the rifle-report being apparently mistaken for the crash of the avalanche. Moreover, like other mountain game, they are frequently unable to ascertain the direction whence the first report proceeds, and being thus in a state of bewilderment, afford easy opportunity for a second or even third shot before making up their minds as to their best line of retreat.

Many ibex are killed during the long winter in the remote Himalayan valleys, not only for the sake of their flesh, but likewise for the valuable pashm, or under-wool, which, like that of the domesticated goat of Kashmir, is woven into the fine soft cloth locally termed pashmina.

The Balti name of the ibex is skin, or iskin, which has been Latinised into the scientific title of the Himalayan race.

a. THIAN SHAN RACE—CAPRA SIBIRICA TYPICA

Characters.—A dark blackish-brown streak down the middle of the back ; front of fore- and hind-legs dark brown, the brown extending round the leg at the fetlock ; below and above this band the hinder and part of the inner surface white to the hocks in the hind-legs ; hinder surface of

fore-legs also white between the lateral hoofs and the knees ; under-parts whitish.

This ibex is represented, in addition to skulls and unmounted skins, by three mounted males in the British Museum, two of which are from the Thian Shan, while the third is from the Altai, the latter locality being apparently the one from which the species was first described. They are all in the winter pelage, which is of the yellowish-white colour tinged with brown or grayish usually seen in specimens shot by English sportsmen, most or all of which are killed in the late spring.

From Baltistan a very dark-coloured ibex has been reported, but was considered by Dr. Scully to be merely the old male in winter pelage. Two skins from the same locality have been subsequently described by Mr. F. W. True, who writes as follows :—"They are in winter pelage and very dark. The colours of the two skins are almost identical, and the markings are very sharply defined, in which latter feature they appear to differ from ordinary specimens of *C. sibirica*." The following is a description of one of these skins :—"Face, neck, breast, fore-legs, shoulders, the lower part of the flanks, the thighs, a line along the spine, and the tail, strong umber-brown. The hind-legs are also brown, but have a sharply-defined, large, oblong, white (or cream-coloured) mark on the postero-external part of the metatarsus, extending from the hock to the outer false hoof, and prolonged between the latter and the true hoof. A white mane (tinged with brown at the extremities of the hairs) extends along the spine from the middle of the nape to the shoulders. The brown of the shoulders follows, and behind this the whole back is occupied by a large elliptical white mark, or saddle (somewhat washed with brown), which is bisected longitudinally by a dark brown spinal line, as already stated. Belly whitish ; ears white at the base anteriorly, brown elsewhere. The beard is blackish-brown, with a few soiled white hairs at its base. A narrow white area surrounds the anal region. All the hairs are white or

whitish at the base—purest where the extremities are merely tinged brown, and less so where they are dark.”

In the white on the lower part of the hind-legs, as well as in the whitish under-parts, these specimens agree with the British Museum examples from the Thian Shan and Altai, but differ by the much darker upper-parts, on which the whitish saddle alone accords with the general coloration of the latter. They agree, however, in their general darkness with Dr. Radde's description of an ibex in the winter pelage from the Sajan Mountains of Eastern Siberia, which is undoubtedly the typical *C. sibirica*.

The explanation of the difference appears to be as follows:—The specimens described by Mr. True were shot, respectively, on the 19th and 21st of December, and were thus in the comparatively early winter pelage. There is no record of the season at which the Altai and Thian Shan specimens in the British Museum were killed; but, as already said, practically all the ibex shot by English sportsmen in the Himalaya and Baltistan are killed in the late spring. Now it is a well-ascertained fact that the lighter-coloured portions of the winter pelage of the wapiti bleach considerably as the season advances; and it appears highly probable that a similar fading takes place in the case of all the races of the present species. In Mr. True's description it is stated that the hairs of many parts of the body are merely tipped with brown; and nothing is more likely than that such tips should bleach to a dirty white after exposure to the storms of winter. Dr. Scully's explanation that the dark individuals are old males in the winter pelage, although true to a certain extent, is insufficient, because the majority of specimens shot by English sportsmen are likewise old males in the winter pelage, and yet are light-coloured.

Distribution.—From the Altai and Sajan ranges through the Thian Shan to the Trans-Indus districts of Gilgit and Baltistan, not extending east of Lake Baikal. The ibex obtained by the English Boundary Commission

from the Parapomismus Mountains of Afghanistan is doubtless this race, whose southern and south-eastern limits are probably defined by the Indus.

b. HIMALAYAN RACE—CAPRA SIBIRICA SAKIN

Capra ibex, Hodgson, *Journ. As. Soc. Bengal*, vol. x. p. 913 (1841), xi. p. 283 (1841), *nec* Linn. 1766.

Capra sakeen, Blyth, *Journ. As. Soc. Bengal*, vol. xi. p. 283 (1841).

Capra ibex hemalayanus, Hodgson, *Calcutta Journ. Nat. Hist.* vol. ii. p. 414 (1842).

Ægoceros skyn, Wagner, Schreber's *Säugethiere*, vol. iv. p. 491 (1844).

Capra himalayana, Schinz, *Synop. Mamm.* vol. ii. p. 463 (1845); Gray, *Knowsley Menagerie*, p. 33 (1850), *Cat. Ungulata Brit. Mus.* p. 150 (1852); Adams, *Proc. Zool. Soc.* 1858, p. 523.

Ibex sakin, Hodgson, *Journ. As. Soc. Bengal*, vol. xvi. p. 700 (1847).

Capra sibirica, Jerdon, *Mamm. India*, p. 292 (1867); Kinloch, *Large Game Shooting*, pt. i. p. 30 (1869); Sterndale, *Mamm. India*, p. 444 (1884); Thomas, *Trans. Linn. Soc.* ser. 2, vol. v. p. 64 (1889).

Capra skyn, Severtzoff, *Ann. Mag. Nat. Hist.* ser. 4, vol. xviii. p. 334 (1878); Prezewalski, *Peters. Mitth. Erzb.* vol. xii. p. 5 (1878).

Capra sakin, Blanford, *Fauna Brit. Ind.—Mamm.* p. 504 (1891).

Characters.—Apparently distinguished from the typical race by the legs being uniformly dark brown throughout, and also by the darker under-parts.

With the hundreds of Himalayan ibex yearly shot by English sportsmen, it is somewhat surprising to find Mr. Blanford remarking that he had only been able to examine one undoubted skin from the Himalaya, and was therefore unable to decide whether the difference in the coloration of the legs formed a constant distinction between the Himalayan and Thian Shan forms. Although years ago I have seen scores of skins, I am at the

present time in no better position to decide the question, which must consequently await further evidence. From the analogy of the Tibetan and Siberian argalis, and the difference between the markhor of Baltistan and that of the Pir-Panjal, I am, however, of opinion that the Himalayan ibex is probably sub-specifically distinct from the Thian Shan and Altai form, and therefore retain the name which has been proposed for it.

Distribution.—The higher elevations of the Himalaya, exclusive of the Pir-Panjal, from the bend of the Indus above Gilgit eastwards, at least as far as the source of the Ganges. Mr. Blanford remarks that this ibex “is not known to occur farther east in the Himalayas nor in Eastern Tibet, and although it is included in Hodgson’s lists of Nepal mammals, there are no specimens in his collection ; but when in Northern Sikkim I heard from Tibetans of an animal, probably this species, inhabiting the mountains north of Shigatze, and Hodgson obtained similar information as to its occurrence north of Lhasa and Digarchi.” Mr. Rowland Ward has, however, recorded ibex heads from Ladak, and I believe that I myself have heard of the existence of the animal in the southern parts of that district.

c. DAUVERGNE’S RACE—CAPRA SIBIRICA DAUVERGNEI

Capra dauvergnei, Sterndale, *Journ. Bombay Nat. Hist. Soc.* vol. i. p. 24 (1886) ; Blanford, *Fauna Brit. Ind.—Mamm.* p. 504 (1891).

Characters.—A provisional race founded on a head purchased in Kashmir, which it is suggested may have come from the districts to the west of that country. The horns are very dark-coloured, much more curved round than is ordinarily the case in the Himalayan race, and are devoid of knobs except near the tips. The latter peculiarity is strongly suggestive of an abnormality. Three specimens are recorded, in the longest of which the horns measure 52 inches along the curve.

9. THE MARKHOR—CAPRA FALCONERI

Ægoceros (Capra) falconeri, Wagner, *Münch. gelehrt. Anzeiger*. vol. ix. p. 430 (1839).

Ægoceros falconeri, Wagner, Schreber's *Säugethiere*, vol. iv. p. 499 (1844).

Capra falconeri, Wagner, in Hügel's *Kaschmir*, vol. iv. p. 579 (1848); Blanford, *Journ. As. Soc. Bengal*, vol. xlv. p. 17 (1875), *Fauna Brit. Ind.—Mamm.* p. 505 (1891); Scully, *Proc. Zool. Soc.* 1881, p. 209; P. L. Sclater, *ibid.* 1886, p. 317; W. L. Sclater, *Cat. Mamm. Ind. Mus.* part ii. p. 145 (1891).

Hircus megaceros, Adams, *Proc. Zool. Soc.* 1858, p. 525; nec *C. megaceros*, Hutton, *sensu strictu*.

Capra megaceros, Jerdon, *Mamm. Ind.* p. 291 (1867); Kinloch, *Large Game Shooting*, part i. p. 37 (1869); Sterndale, *Mamm. Ind.* p. 441 (1884).

Hircus falconeri, Gray, *Cat. Ruminants Brit. Mus.* p. 53 (1872), *Hand-list Ruminants Brit. Mus.* p. 126 (1873).

Plate XXV.

Characters.—Build heavy and massive, height at shoulder varying from 35 to 41 inches. Hair on the body and legs short in summer, long and silky in winter, with little or no under-fur; in old males at all seasons a profuse beard, extending from the chin down the throat to the chest, and upwards along the sides of the neck to the base of the ears and nape; in young males and females the beard short and restricted to the chin. Horns of males much compressed, situated close together, and twisted into a spiral, with the front keel turning at first in an outward direction; in young individuals sharply angulated both in front and behind, but the front of the base becoming rounded with increasing age; the form of the spiral varying from that of a very open corkscrew to that of an ordinary screw, of which



ASTOR MARKHOR.

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the two keels form the worm ; in females the horns short, compressed, and spiral. General colour in winter gray, in summer rich reddish-brown, but in old males whitish throughout ; the long hairs of the winter pelage white at the base, with brown tips ; the under-parts lighter than the back, in some cases whitish ; a dark stripe on the front of the legs from the knees and hocks to the fetlocks ; beard of males black in front, light gray behind ; tail dark brown ; and in young animals the general colour uniformly grayish-brown, with a dark stripe down the middle of the back, and, it is said, the beard wholly black. Horns deep black.

The markhor (literally snake-eater) is entitled to rank as one of the handsomest, if not actually the handsomest, of all the wild goats. The horns indicate four more or less distinct types, the extreme modifications of which differ much more widely from one another than do the horns of many species ; but since all the four types more or less completely intergrade, it is evident they must be ranked as geographical races, and can have no claim to specific rank. There is also an extinct form from the Siwalik Hills, which likewise seems best regarded as a race, although specimens less imperfect than those known might show specific characters.

The form of the horns and the nature of the beard are amply sufficient to prove that the markhor has no close affinity with any of the other Asiatic wild goats. Its occurrence in the Pliocene deposits of the Siwaliks indicates that it is evidently an ancient type. And although its beard is different, the shape and contour of the horns, together with their black colour, so different from that of the true ibex, are strongly suggestive that its closest affinities are with the Spanish tur.

Its connection with the parentage of the wild goat has been already referred to under the heading of *Capra hircus*. With regard to its alleged snake-killing propensities, it may be mentioned that, while there is no definite information available as to their truth or otherwise, precisely the same attribute is assigned to the common goat in Scotland.

The habits of this noble species may be best considered under the heading of the different races. Information is much needed whether these show any difference in the coloration of the pelage, or whether they differ solely in respect of the horns and size.

Distribution.—The Kajnag and Pir-Panjal ranges south of Kashmir to as far east as the valley of the Chinab ; the ranges of Baltistan, Astor, and Gilgit to the north ; Hazara and several of the hill-ranges of Afghanistan, such as the Suleman range as far south as Gendari Hill near Mithankot, and likewise Takatu and Chehiltan near Quetta. In the Pliocene epoch the plains of the Punjab.

The weight of specimens of the larger races of the markhor ranges from 180 to 240 lbs.; the actual records being 184, 204, and 240 lbs.

a. ASTOR RACE—CAPRA FALCONERI TYPICA

Capra falconeri, Ward, *Records of Big Game*, p. 236 (1896).

Characters.—Size large, probably fully equal to that of the next race. Horns of males forming an extremely open spiral, apparently never exceeding one and a half turns.

Distribution.—Astor and Baltistan ; apparently intergrading with the next race on the confines of Hazara and Gilgit.

Habits.—Like the other races of the species, the Astor markhor frequents the most difficult and precipitous ground, where, in spite of its size and weight, its agility is fully equal to that of any other member of the genus. So precipitous, indeed, is the country where it is found, that a considerable proportion of the heads shot are irretrievably ruined by falling from the cliffs into the valleys below. Congregating for a considerable part of the year in herds, from which, however, the old bucks separate themselves in summer, they live almost entirely in the open, resorting to

the patches of forest only when driven thereto in order to escape the torments inflicted by the swarms of gadflies during the hot months of the year. In the winter, especially after heavy falls of snow, they are driven down by the cold from the higher grounds to the cliffs overhanging the main streams, or occasionally to even still lower levels, Colonel J. Biddulph



FIG. 54.—Front view of Head of male Astor Markhor. (From Darrah's *Sport in the Highlands of Kashmir*.)

relating that he once captured an adult buck in the Residency garden at Gilgit. The absence of the coat of under-fur, or pashm, is doubtless the reason that the markhor is so much more susceptible of cold than its relative the ibex. In May these animals once more ascend to join the ibex, which in this district appear never to leave the higher pastures; and in June both ibex and markhor may be seen feeding together—a somewhat

remarkable association, when it is remembered that the former species is unknown in the typical habitat of the Pir-Panjal race of the latter. In Astor and Gilgit the young, which may be either one or two in number, are born in May and June.

Markhor, probably of the Pir-Panjal race, have repeatedly bred in captivity with the domestic goat.



FIG. 55.—Oblique view of Head of male Astor Markhor. (From Darrah's *Sport in the Highlands of Kashmir*.)

b. PIR-PANJAL RACE—*CAPRA FALCONERI CASHMIRIENSIS*

Characters.—Size large, the height reaching to 40 or 41 inches at the shoulder. Horns of males with the spiral less open than in the typical race, and showing in fine examples from one to two complete turns. As observed by Mr. Blanford, the horns of this race pass into those of the last and the next by every conceivable gradation, probably on the confines of their respective distributional areas.

The following are some of the largest dimensions of horns of this and the preceding race recorded by Mr. Rowland Ward :—

Pir-Panjal Markhor

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Length along Outer Curve.	Length in Straight Line.	Basal Circumference.	Tip to Tip.	Locality.
59	?	?	?	Pir-Panjal
$58\frac{1}{2}$	$40\frac{1}{2}$	10	$38\frac{1}{2}$	Gilgit
56	?	?	?	Astor
56	?	$13\frac{1}{3}$	?	"
55	?	?	?	"
$54\frac{1}{4}$	?	$10\frac{1}{2}$	$26\frac{1}{2}$	?
54	?	$10\frac{5}{8}$	$33\frac{3}{4}$	Astor
$53\frac{1}{4}$	$42\frac{1}{2}$	$11\frac{1}{2}$	52	"
53	?	$9\frac{1}{2}$	26	?
53	$38\frac{3}{4}$	$9\frac{3}{4}$	$35\frac{1}{2}$	Gilgit
$52\frac{3}{4}$	$39\frac{3}{4}$	$12\frac{1}{8}$	$33\frac{3}{4}$	Astor
52	35	$9\frac{1}{2}$	$42\frac{1}{2}$	Gilgit
$51\frac{3}{8}$	$37\frac{1}{8}$	10	33	Pir-Panjal
$51\frac{1}{8}$	?	$11\frac{3}{8}$	$49\frac{3}{8}$	Astor
51	37	11	42	"
50	$36\frac{1}{2}$	12	36	Chilas
$49\frac{1}{4}$	?	10	39	Kajnag
49	$32\frac{1}{4}$	$10\frac{1}{4}$	43	Gilgit
49	?	11	35	Haramosh
49	?	?	42	Astor
$48\frac{1}{2}$	?	$11\frac{1}{2}$	45	"
$48\frac{1}{4}$	?	$11\frac{7}{8}$	$29\frac{3}{8}$	?
$47\frac{1}{2}$	?	11	?	Pir-Panjal
47	36	$11\frac{5}{8}$	39	"

Distribution.—The Pir-Panjal and Kajnag ranges on the south side of the valley of Kashmir, unknown on the northern side of that valley, and not extending farther east than the Chinab; to the north-west in Hazara and Gilgit. In not extending to the northward of the vale of Kashmir, the distribution of this race is similar to that of the Himalayan tahr, although it is more extended to the north-west in that it crosses the Jhelam valley to include the Kajnag range.

Habits.—The Pir-Panjal markhor is one of the animals in imminent danger of extermination in its typical habitat, unless the new forest laws of the Kashmir Government are sufficiently stringent to enable it to

recover its numbers. At the time that I knew the district, markhor were nearly always to be met with at the head of a small valley flowing into the Jhelam near its bend below Naoshera ; but of late years, I am informed, they have become extremely scarce there.

Unlike the Astor race, the Pir-Panjal markhor is a thoroughly forest-dwelling goat, its true home being the precipitous cliffs in the thick forests of its native range, from which it sallies forth at times to graze on

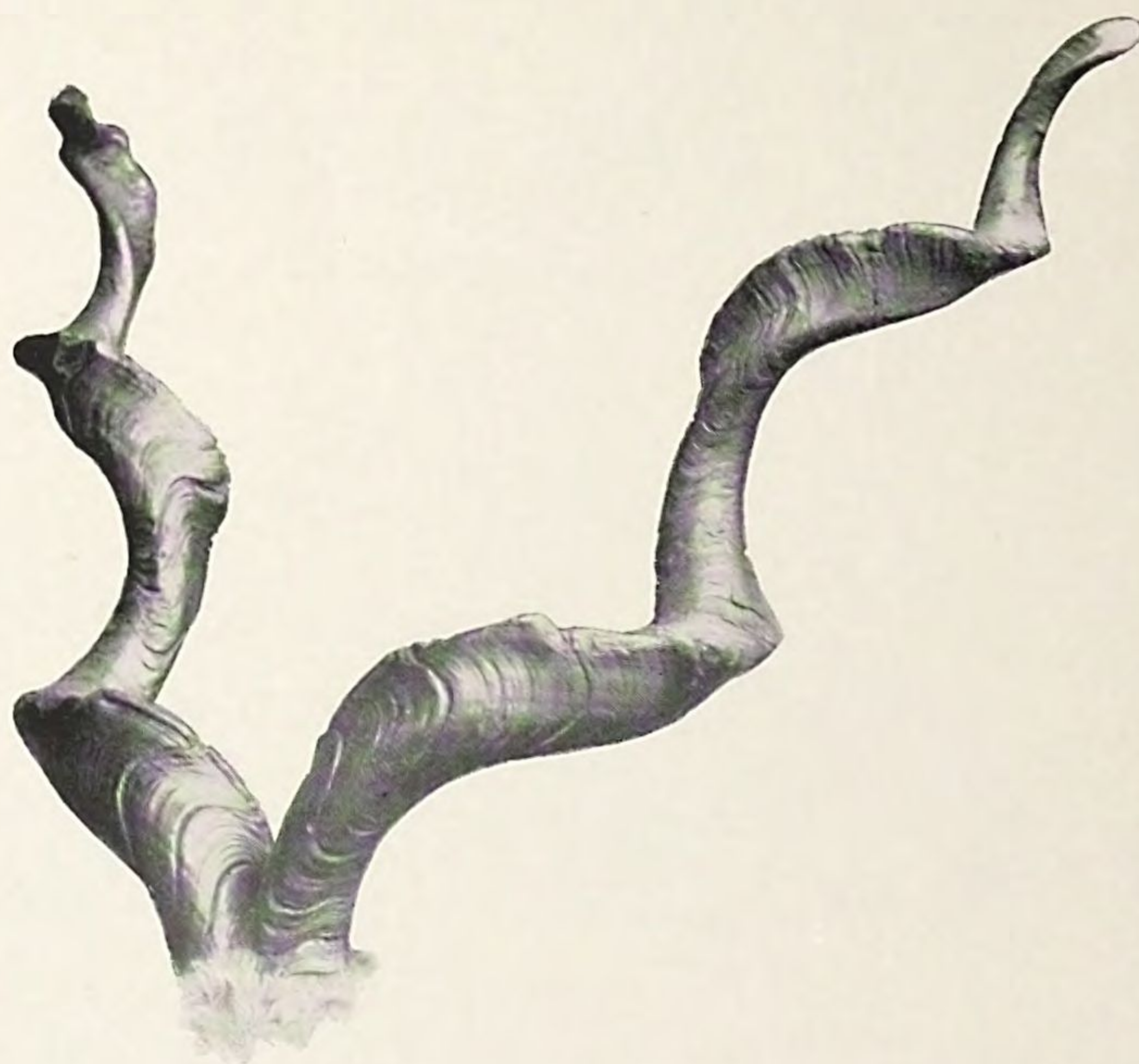


FIG. 56.—Horns of male Pir-Panjal Markhor.

the higher slopes of the mountains. After the storms which are so frequent at many seasons of the year in the Panjal and Kajnag ranges, markhor are almost sure to show themselves in the open glades at the first gleam of sunshine ; and it is consequently at such times that they should be most carefully looked for by the sportsman.

The forests in which the markhor dwell are chiefly of pines and birch, and these alternate with steep grassy slopes and precipitous cliffs of slaty or trappean rock. During the day the markhor remain concealed in the most secluded depths of the forest, issuing forth to feed only

in the mornings and evenings. In the spring individuals of all sizes and ages are to be seen together in the herds, but as the summer advances the does usually retire to the more open ground above the forest belt, while the old males restrict themselves still more exclusively to the latter, and are consequently almost impossible to discover. And here it may be remarked that by the shikaris of the Pir-Panjal the name markhor is applied exclusively to the hoary old bucks, the younger males being termed rind, and the females bakri, or she-goat. According to General M'Intyre, the does appear generally to produce only a single kid at a birth, as none were observed by him with twins.

Owing to the badness of the ground these animals frequent, markhor-shooting is one of the most dangerous of Himalayan sports. As General Kinloch observes, they "must be followed over steep inclines of short grass, which the melting snow has left with all the blades flattened downwards; and amid pine-trees, whose needle-like spines strew the ground and render it more slippery and treacherous than ice. If one falls on such ground one instantly begins to slide down the incline with rapidly increasing velocity, and unless some friendly bush or stone arrests one's progress, the chances are that one is carried over some precipice, and either killed or severely injured."

c. CABUL RACE—CAPRA FALCONERI MEGACEROS

Capra megaceros, Hutton, *Calcutta Journ. Nat. Hist.* vol. ii. p. 535, pl. xx. (1842), *Journ. As. Soc. Bengal*, vol. xv. p. 161 (1846); Ward, *Records of Big Game*, p. 236 (1896).

Characters.—Size apparently medium. Horns of male nearly straight, but still showing a slightly open spiral, being in fact intermediate between those of the Pir-Panjal and Suleman races, with both of which they intergrade.

Distribution.—The Trans-Indus districts in the neighbourhood of Cabul, and perhaps farther south; thus forming the extreme north-westerly limits

of the species. Nothing seems to have been recorded with regard to the habits of this race.

d. SULEMAN RACE—CAPRA FALCONERI JERDONI

Capra jerdoni, Hume, *Proc. As. Soc. Bengal*, 1874, p. 240; Kinloch, *Large Game Shooting*, pt. ii. p. 15 (1876); Ward, *Records of Big Game*, p. 239 (1896).

Characters.—Size relatively small, the height at the shoulder not exceeding 38 inches. Horns of male comparatively short, and forming a perfectly straight cone, upon which the front and hind keels are wound in a sharp spiral, so as to show in fine specimens two or three complete turns. Beard said to be less developed than in the two first races.

The above are the characters of the horns of this race from the Suleman range, but many of those from neighbouring districts show a complete passage into those of the Cabul race.

The following are the measurements of the horns of the present and preceding races given in Mr. Rowland Ward's book :—

Length in a Straight Line.	Basal Circumference.	Tip to Tip.	Locality.
$38\frac{1}{2}$	$10\frac{1}{2}$	$23\frac{7}{8}$	Afghanistan
35	?	?	„
$34\frac{3}{4}$	$10\frac{3}{8}$	28	Baluchistan
33	$9\frac{1}{4}$	$19\frac{3}{4}$	Afghanistan
$32\frac{1}{2}$	10	$22\frac{1}{2}$	Bunu
$32\frac{1}{4}$	$9\frac{3}{4}$	28	?
$31\frac{1}{2}$	$9\frac{1}{2}$	27	Suleman Range
$30\frac{3}{4}$	$8\frac{3}{4}$	$21\frac{1}{2}$	?
$29\frac{3}{4}$	$8\frac{1}{4}$	$23\frac{3}{4}$	Baluchistan
28	?	?	?
$27\frac{1}{8}$	$8\frac{3}{4}$	21	Sheik Budin
27	9	18	„
26	$8\frac{3}{4}$	$18\frac{1}{2}$	„
24	$9\frac{3}{4}$	20	?
24	?	?	Sheik Budin
$22\frac{1}{2}$	$10\frac{1}{4}$	$15\frac{3}{4}$	E. Afghanistan

Distribution.—The Trans-Indus hill-ranges of the Punjab frontier, Afghanistan, and Baluchistan, extending in the Suleman range as far south as the neighbourhood of Mithankot, and also found in the Quetta district. Colonel Percy, in the *Badminton Library*, remarks that the straight-horned markhor, as he terms the present race, “is found all over the low ranges that run parallel to the right bank of the Indus below Attock; it used to be found in fair numbers near Sheik Budin, a small station near Dera Ismail Khan, and in the hills, or rather the steep ravines, in the plateau behind Dera Ghazi Khan.”

I have never seen a skin of this race, which is known to me only by the skull and horns, of which there are several good examples in the British Museum.

Habits.—As the greater part of the distributional area of this race is more or less inaccessible to European sportsmen, very little is known as to its habits. The hills on which it is found are, however, for the most part at least, bare and desolate, with a summer climate of great heat. In this respect the present race is analogous to the Punjab urial; and, as with that race, its relatively small size is probably due to the hot climate, both sheep and goats apparently attaining their maximum size, both of body and horns, in regions where the temperature is comparatively low.



FIG. 57.—Horns of male Suleman Markhor. (Rowland Ward, *Records of Big Game*.)

e. SIWALIK RACE—CAPRA FALCONERI PUNJABIENSIS (*Extinct*)

Capra, sp., Lydekker, *Palæontologia Indica* (*Mem. Geol. Surv. Ind.*) ser. 10, vol. i. p. 171, pl. xxviii. fig. 3 (1880), *Cat. Siwalik Vert. Ind. Mus.* pt. i. p. 17 (1885).

Characters.—Known only by three broken horn-cores in the Indian

Museum, Calcutta, which appear to have belonged to immature individuals most nearly related to the Cabul race.

Distribution.—The Potwar, and probably other districts of the Punjab.

V. THE TAHR—GENUS HEMITRAGUS

Hemitragus, Hodgson, *Journ. As. Soc. Bengal*, vol. x. p. 913 (1841); Gray, *Cat. Ungulata Brit. Mus.* p. 144 (1852), *Cat. Ruminants Brit. Mus.* p. 51 (1872); Blanford, *Fauna Brit. Ind.—Mamm.* p. 508 (1891).

Kemas, Gray, *Cat. Ungulata Brit. Mus.* p. 146 (1852), *nec* Ogilby 1836.

Characters.—Nearly allied to *Capra*, but the males without a beard, and the horns, which are placed close together at the base, comparatively short, not greatly exceeding the head in length, and those of the females not very much smaller than those of the males. A small naked area on the extremity of muzzle. Males odoriferous. No glands on the face, in the groin, or between the hoofs. Females with either two or four teats. The horns, which rise from the skull in the same plane as the forehead, curve backward, and are angulated in front and compressed. The skull is characterised by its long and narrow form and the slight prominence of the rims of the sockets of the eyes; the plane of the occiput being flat and meeting that of the forehead at a right angle, or somewhat less. Horns always black.

Distribution.—The Himalaya, the Nilgiri, Anamalai, and some of the other ranges of Southern India, and the mountains of South-Eastern Arabia; in the outer Himalaya dating from the Pliocene epoch. The distribution of this genus is decidedly remarkable. Its earliest known occurrence is in Northern India; and in former times it would appear to have existed at or near the sea-level, at an epoch when there was a freer land communication with Arabia than is at present the case. With an increase in temperature, one species would appear to have taken refuge in the Himalaya, a second



HIMALAYAN TAHR.

in the mountains of Southern India, and the third in those of South-Eastern Arabia.

In habits tahr are very similar to the true goats.

I. THE HIMALAYAN TAHR—HEMITRAGUS JEMLAICUS

Capra jemlanica, H. Smith, in Griffith's *Animal Kingdom*, vol. iv. p. 308 (1827); P. L. Sclater, *Proc. Zool. Soc.* 1886, p. 317.

Capra jemlahica, H. Smith, *op. cit.* vol. v. p. 358 (1827); Jardine, *Naturalist's Library—Mamm.* vol. iv. p. 117 (1836).

Capra jharal, Hodgson, *Asiatic Researches*, vol. xviii. pt. ii. p. 129 (1833), *Proc. Zool. Soc.* 1834, p. 106, *Journ. As. Soc. Bengal*, vol. iv. p. 491 (1835).

Capra quadrimammis, Hodgson, *Journ. As. Soc. Bengal*, vol. iv. p. 710 (1835), v. p. 254 (1836).

Hemitragus quadrimammis, vel *jharal*, Hodgson, *op. cit.* vol. x. p. 913 (1841).

Hemitragus jemlaicus, Gray, *Cat. Osteol. Brit. Mus.* p. 60 (1847), *Knowsley Menagerie*, p. 32 (1850), *Cat. Ungulata Brit. Mus.* p. 144 (1852), *Cat. Ruminants Brit. Mus.* p. 51 (1872); Adams, *Proc. Zool. Soc.* 1858, p. 532; Jerdon, *Mamm. Ind.* p. 286 (1867); Blanford, *Journ. As. Soc. Bengal*, vol. xli. p. 40 (1872), *Fauna Brit. Ind.—Mamm.* p. 509 (1891); Kinloch, *Large Game Shooting*, pt. ii. p. 11 (1876); Lydekker, *Journ. As. Soc. Bengal*, vol. xlvi. p. 286 (1877); Ward, *Records of Big Game*, p. 233 (1896).

Kemas jemlaicus, Gervais, *Hist. Nat. Mamm.* vol. ii. p. 188 (1855).

Capra (Hemitragus) jemlaicus, Sterndale, *Mamm. Ind.* p. 449 (1884).

Capra jemlaica, Flower and Garson, *Cat. Osteol. Mus. Coll. Surg.* pt. ii. p. 250 (1884); W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 146 (1891).

Plate XXVI.

Characters.—Size large, the height at the shoulder ranging between 36 and 40 inches. Build somewhat heavy and clumsy, with the face long, narrow, and straight. Horns almost or quite touching at the base, greatly compressed, flattened on each side from a short distance above the base, the sides distinctly ridged transversely, and the front inner angle forming a sharp nodular keel, diverging from the base and curving



FIG. 58.—Head of male Himalayan Tahr. (Ward, *Records of Big Game*.)

backwards sharply, but somewhat convergent at the tips. Head covered with short hair; the hair on the body soft and much longer, and on the neck, shoulders, and chest elongated so as in old males to form a shaggy mane reaching at least as low as the knees. General colour rich dark or reddish-brown, darkest in old males, but in some cases paler, and the fore part of the mane in old males generally whitish or hoary; the individual hairs pale at their bases and dark brown towards the tips; face and front surface of the legs very dark brown, sometimes almost black; a dark streak down the middle of the back, which is, however, very indistinct in old males; hinder surfaces of the limbs pale or rusty

red in the males; immature individuals grayish-brown, and kids very pale-coloured. Tail short, flattened, and naked on the under surface; knees and chest furnished with callous pads; and the females with four teats. An adult male will weigh about 200 lbs.

The distinctive features of this, the typical, species are the large size, the sharply-keeled nodose, compressed horns, the long soft mane of the males, and the four teats of the females.

Mr. Blanford records a maximum horn-length of $16\frac{1}{2}$ inches, but the following are some of the largest measurements given in Mr. Rowland Ward's book :—

Length along Front Curve.	Basal Circumference.	Tip to Tip.
$14\frac{5}{8}$	?	?
$14\frac{1}{4}$	$8\frac{7}{8}$	$4\frac{3}{8}$
$14\frac{1}{8}$	$8\frac{7}{8}$	$6\frac{5}{8}$
14	?	?
$13\frac{7}{8}$	9	$8\frac{3}{8}$
$13\frac{3}{4}$	9	$11\frac{1}{4}$
$13\frac{5}{8}$	8	$6\frac{1}{4}$
$13\frac{1}{2}$	$8\frac{1}{2}$	$6\frac{3}{4}$

Distribution.—The forest districts of the middle Himalaya, from the Pir-Panjal to Sikkim; abundant in the lower Wardwan, Kistwar, and Chamba districts, as it is in Gahrwal. Apparently unknown in the Kajmag range, and not occurring in the ranges to the north of the valley of Kashmir, its limits in these districts being thus bounded to the north and north-west by the valley of the Jhelam river.

Habits.—In the Simla district the name of this species is tahr or tehr, but in Kistwar it is known as kras, and in Kashmir as jagla. Although I have hunted tahr in the valley of the Chinab, I have had but little opportunity of studying their habits in detail, and am therefore compelled to quote from the writings of those who have been more favoured. Among these accounts that of General A. A. Kinloch is one of the best :—“The tahr,” he writes, “is, like the markhor, a forest-loving animal, and although it sometimes resorts to the rocky summits of the hills, it generally prefers the steep slopes which are more or less clothed with trees. Female tahr may frequently be found on open ground; but old males hide a great deal in the thickest jungle. Nearly perpendicular hills with dangerous precipices, where the forest consists of oak and ringal cane, are the favourite

haunts of the old tahr, who climb with ease over ground where one would hardly imagine that any animal would find a footing." General Macintyre,¹ whose account is likewise good, also bears testimony to the difficult nature of the ground frequented by tahr :—"This ruminant," he writes, "is plentifully distributed over the precipitous rocky slopes just below the snow-line, and is occasionally found on some of the higher parts of the middle ranges, where, however, it appears not to attain the same size as it does in the higher regions below the snow-line. I have never seen a more truly wild-looking animal in the Himalayas than an old buck tahr, with his long frill-like mane and shaggy coat of dark grayish-brown, short sturdy legs, and almost black face. . . . An old buck stands over 3 feet at the shoulder. The doe, called 'tehrug,' is smaller, lighter in colour, and less shaggy, with horns of the same shape, but much smaller than those of the buck. The great old bucks herd separately during the summer till October, generally betaking themselves to the wildest and most unapproachable places. Their colour is often so dark as, at a distance, almost to look like black, more especially in the autumn. The flesh of the tahr is considered by the hill-men to be a great medicine for fever and rheumatism; and shikaris often dry the flesh and sell it, and even the bones, in places where fresh tahr-meat is not procurable."

So bad is much of the ground frequented by these animals, that specimens when shot frequently smash themselves into a pulp in their fall down the frightful precipices. The pairing season takes place in the winter months, and the kids, of which usually only one is produced at a birth, are born in the following June or July, so that the period of gestation would appear to be about six months.

In confinement tahr thrive well. They have been tried in the park at Woburn Abbey, but some of the males developed the extraordinary habit of ripping open the fallow deer with their sharp horns, and consequently

¹ *Hindu-Koh*, Edinburgh and London, 1891.

had to be destroyed. It is to this pernicious habit that the British Museum owes the two handsome specimens now exhibited in the lower mammalian gallery.

2. THE SIWALIK TAHR—HEMITRAGUS SIVALENSIS (*Extinct*)

Capra sivalensis, Lydekker, *Palæontologia Indica* (*Mem. Geol. Surv. Ind.*), ser. 10, vol. i. p. 169 (1878), *Cat. Foss. Mamm. Brit. Mus.* pt. ii. p. 45 (1885).

Hemitragus sivalensis, Blanford, *Fauna Brit. Ind.—Mamm.* p. 509 (1891).

Characters.—Apparently very closely allied to the existing Himalayan species, of which it may be merely the ancestral race. It is known by two imperfect skulls with the horn-cores in the British Museum.

Distribution.—Northern India during the Pliocene epoch.

3. THE ARABIAN TAHR—HEMITRAGUS JAYAKERI

Hemitragus jayakeri, Thomas, *Ann. Mag. Nat. Hist.* ser. 6, vol. xiii. p. 365 (1894), *Proc. Zool. Soc.* 1894, p. 452, pl. xxxi.

Hemitragus jaykeri, Ward, *Records of Big Game*, p. 234 (1896).

Characters.—Size small, the height at the shoulder being only about $24\frac{1}{2}$ inches; build comparatively light and slender. Pelage coarse, shaggy, and brittle, the texture of the hairs being much more like that of some of the larger species of sheep, or even the musk-deer, than that of the Himalayan thar; on the greater part of the body the hair of medium length, shorter than in the Himalayan, but longer than in the Nilgiri species; on the nape of the neck and the middle line of the fore part of the back elongated into a mane, and the hair below the angles of the lower jaw, as well as that on the upper part of the fore- and hind-legs likewise long, so that more or less distinct tufts are formed at the knees and hocks. General colour pale sandy or whitish-brown, the mane on the back being

broadly tipped with blackish-brown ; the face, the cheeks below the eyes, the backs of the ears, the tail, and a mark on each fetlock black or blackish. Horns of the general type of those of the Himalayan species, but relatively longer, more slender, less ridged on the sides, and less knotted on the front edge. In the ~~female~~ male, at least, the teats are only two in number. Certain differences in the form and proportions of the skull between this and the Himalayan species are mentioned in the original description, among them being the prominence on the forehead, which almost recalls the boss found in the Abyssinian ibex, and the relative shortness of the nasal bones.

The distinctive features of this species are its small size, which is less

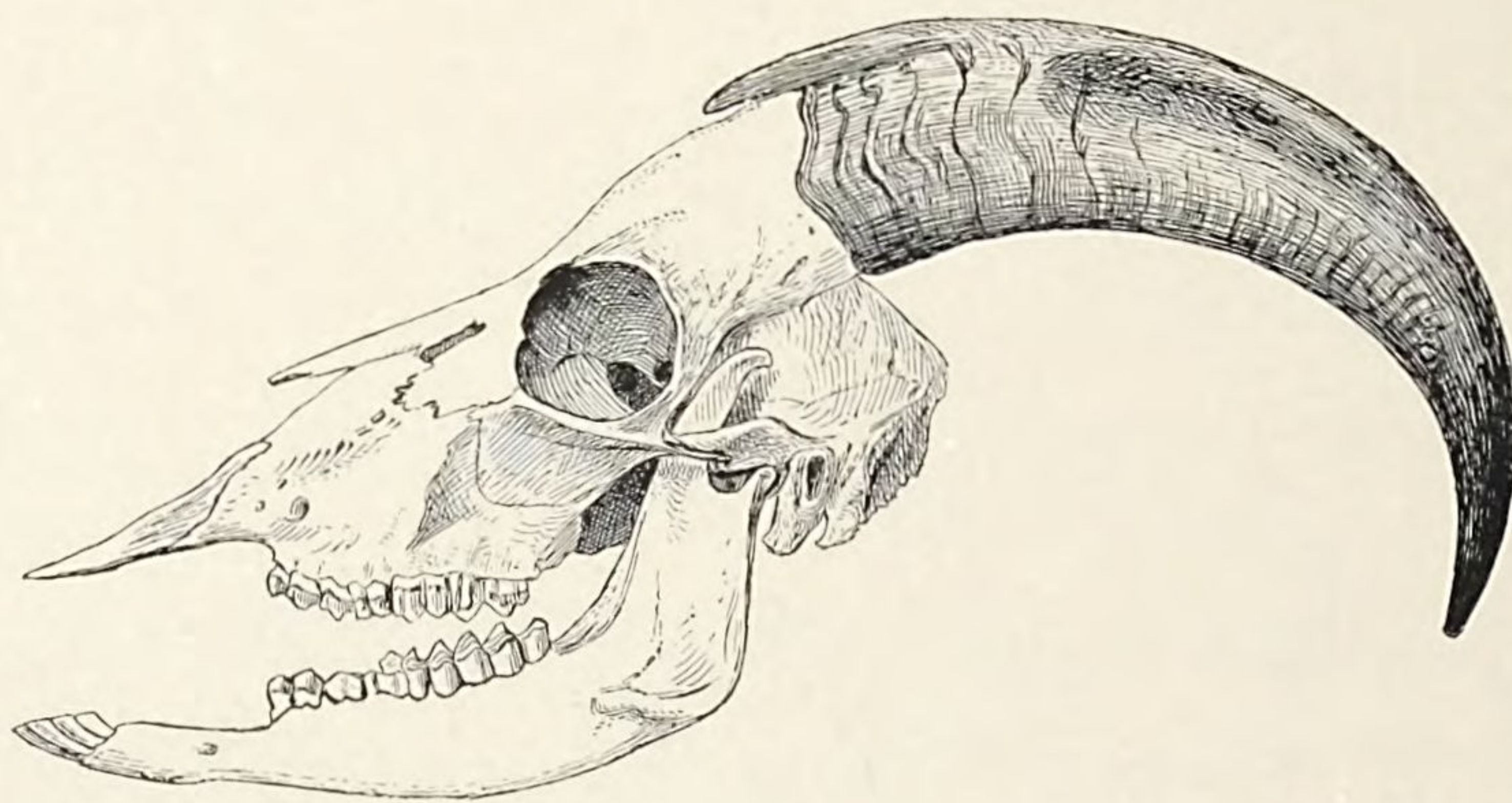


FIG. 59.—Skull and horns of male Arabian Tahr. (From Thomas, *Proc. Zool. Soc.* 1894.)

than in any other wild goat, the keeled, slightly nodose, compressed, slender horns, the slight development of the mane and brittleness of the hair, and the apparent presence of only two teats.

The only examples at present known are two skins in the British Museum, one of which is mounted and exhibited in the lower mammalian gallery.

Distribution.—The mountains of Oman, South-Eastern Arabia ; definitely known from the Akhdar and neighbouring ranges.

Habits.—Although nothing has been ascertained with regard to the habits of this tahr, Dr. Jayakar, its discoverer, as quoted by Mr. Thomas,



NILGIRI TAHR.

writes as follows :—" I should think, from the description given to me, that these goats were in all probability shot at a great height, between 1500 and 2000 feet. I have no personal knowledge of the habits of the animal, but I am informed by the Arabs that it does not go in large herds, but in groups of a few individuals. As there appears to be a good deal of vegetation above a certain height, it seems that they rarely, if ever, come down into the valleys below. I believe the same species is to be found throughout the whole of the hilly part of Oman ; it occurs in Jalan Shar-keeyeh and the Jebel Akhdar range, and in all its offshoots."

In both the British Museum specimens the horns are much worn, as if by rubbing against rocks or trees.

4. THE NILGIRI TAHR—HEMITRAGUS HYLOCRIUS

Kemas hylocrius, Ogilby, *Proc. Zool. Soc.* 1837, p. 81 ; Flower and Garson, *Cat. Osteol. Mus. Coll. Surg.* pt. ii. p. 254 (1884).

Capra (Ibex) warryato, Gray, *Ann. Mag. Nat. Hist.* ser. 1, vol. x. p. 267 (1842).

Capra warryato, Gray, *List. Mamm. Brit. Mus.* p. 168 (1843).

Hemitragus warryato, Gray, *Knowsley Menagerie*, p. 31 (1850).

Kemas warryato, Gray, *Cat. Ungulata Brit. Mus.* p. 146 (1852), *Cat. Ruminants Brit. Mus.* p. 51 (1872).

Hemitragus hylocrius, Blyth, *Journ. As. Soc. Bengal*, vol. xxviii. p. 291 (1859) ; Jerdon, *Mamm. Ind.* p. 288 (1867) ; M'Master, *Notes on Jerdon's Mamm.* p. 117 (1870) ; Blanford, *Fauna Brit. Ind.—Mamm.* p. 511 (1891) ; Ward, *Records of Big Game*, p. 231 (1896).

Capra (Hemitragus) hylocrius, Sterndale, *Mamm. Ind.* p. 451 (1884).

Capra hylocrius, P. L. Sclater, *Proc. Zool. Soc.* 1886, p. 318 ; W. L. Sclater, *Cat. Mamm. Ind. Mus.* pt. ii. p. 146 (1891).

Plate XXVII.

Characters.—Build much the same as in the Himalayan tahr, but the size rather larger, the height at the shoulder varying from 39 to 42 inches in the males, although not exceeding 35 inches in the females. Face slightly concave on the forehead and a little convex on the lower part of the nose. Hair short, thick, and coarse, forming a short stiff mane on the back of the neck and shoulders in males. Horns nearly in contact at their



FIG. 60.—Side view of head of male Nilgiri Tahr. (Rowland Ward, *Records of Big Game*.)

bases, from which they run almost parallel for some distance, then curving rapidly backwards and gradually diverging; transversely wrinkled throughout their extent; the inner surface flat, the outer highly convex, with a low compressed keel on the front inner edge, the hinder aspect rounded. General colour dark yellowish-brown, with a grayish tinge in the does and kids; a dark streak down the middle of the back, and the under-parts paler. In old males the general colour of the upper-parts dark sepia-brown, passing into blackish on the face; a fawn-coloured ring round each eye, a patch behind the same and a streak down the sides of the face grizzled gray; a large saddle-shaped patch on the loins grizzled white,

becoming almost pure white in very aged individuals ; the legs also grizzled with white, dark blackish-brown in front, paler behind ; knees with thickened callous pads ; females with two teats.

The distinctive features of the warri-atu, as this tahr is locally called, are the generally short and stiff hair, the strong convexity of the outer sides of the horns, and the presence of only two teats in the female.

The following are some of the largest horn-measurements recorded in Mr. Rowland Ward's book :—

Length along Front Curve.	Basal Circumference.	Tip to Tip.
$16\frac{3}{4}$	$8\frac{7}{8}$	$5\frac{5}{8}$
$16\frac{1}{2}$	?	?
$15\frac{1}{2}$	$8\frac{5}{8}$	$7\frac{7}{8}$
$15\frac{3}{8}$	$8\frac{3}{4}$	$6\frac{3}{4}$
$15\frac{3}{8}$	$8\frac{1}{4}$	6
$15\frac{1}{8}$	$8\frac{5}{8}$	$4\frac{3}{4}$
$15\frac{1}{8}$	$8\frac{5}{8}$	$4\frac{3}{8}$
$14\frac{3}{4}$	$8\frac{7}{8}$	$5\frac{1}{2}$
$14\frac{1}{2}$	$8\frac{3}{4}$	$6\frac{1}{4}$
$14\frac{1}{2}$	$8\frac{5}{8}$	$5\frac{1}{8}$
$14\frac{3}{8}$	8	$4\frac{5}{8}$
$14\frac{1}{4}$	$8\frac{1}{4}$	4
$14\frac{1}{4}$	8	$4\frac{1}{2}$
$14\frac{1}{8}$	$8\frac{5}{8}$	$5\frac{1}{2}$
14	$7\frac{3}{4}$	$6\frac{1}{2}$
14	$7\frac{5}{8}$	$6\frac{3}{8}$
$12\frac{5}{8}$	$7\frac{3}{4}$	$4\frac{3}{4}$

The largest female horns on record have a length of $11\frac{1}{8}$ inches, with a basal circumference of $5\frac{3}{4}$ inches.

Distribution.—The mountain ranges of Southern India, namely the Nilgiris and Anamalais, and the Western Ghats from the Anamalais nearly to Cape Comorin ; generally at elevations between 4000 and 6000 feet above the sea-level, although occasionally considerably lower. With the exception of the Arabian tahr and the Abyssinian ibex, the present

is the only species of wild goat living southward of the northern tropic.

Habits.—The Nilgiri ibex, as it is commonly called by English sportsmen, has suffered much from incessant pursuit, in consequence of which its numbers have been greatly diminished. The Madras Government has, however, recently enacted forest-laws for its protection, and a special permit is necessary for shooting, so that there are hopes it will once more increase. The best accounts of its habits are those given by Col. Douglas Hamilton, “Hawkeye,” and Mr. Blanford. From these it appears that the Nilgiri tahr was formerly found in herds numbering from 5 to 50 or 60 head, although occasionally, from the temporary amalgamation of different herds, considerably more might be seen together. Their favourite haunts are the crags and precipices above the forest level, the interspersed slopes of grass affording their feeding grounds ; but they occasionally venture on to the open grassy tracts forming the plateau at the summit of the hills. Like other goats, they feed during the mornings and evenings, reposing beneath the shelter of rocks during the day. They are exceedingly difficult to stalk, being as active and wary as their Himalayan relative, but, like that species, suspecting danger from below rather than from above, and the old does acting as sentinels to the herds. Their chief foes are leopards, though a few fall victims to prowling tigers, and others doubtless to packs of wild dogs. Two kids appear to be generally produced at a birth ; and as kids may be seen with the herds throughout the greater part of the year, there does not seem to be any definite breeding season.

The following extract from the pen of “Hawkeye” admirably describes the wariness of the species :—“Usually before reposing, one of the herd, generally an old doe, may be observed intently gazing below, apparently scanning every spot in the range of her vision, sometimes for half an hour or more before she is satisfied that all is well ; strange to say, seldom or ever looking up to the rocks above. Then, being satisfied on the one side, she

observes the same process on the other, eventually calmly lying down, contented with the precautions she has taken that all is safe. Her post as sentinel is generally a prominent one, on the edge and corner perhaps of some ledge, well sheltered from the wind and warmed by the sun, along which the rest of the herd dispose themselves as inclined, fully trusting in the watchful guardian whose manœuvres I have been describing. Should the sentinel be joined by another, or her kid come and lie down by her, they invariably place themselves back to back, or in such a manner that they can keep a lookout on either side. A solitary male goes through all this by himself, and wonderfully careful he is, but when with the herd he reposes in security, leaving it to the females to take precautions for their mutual safety."

From the conspicuous grizzled mark on the loins, the old males are commonly termed by sportsmen "saddle-backs."



FIG. 61.—Front view of Head of male Nilgiri Tahr. From a specimen in the possession of Mr. St. George Littledale.

APPENDIX

BIBLIOGRAPHY OF WILD OXEN, SHEEP, AND GOATS

THE following list, which makes no pretence to be complete, includes only works and memoirs devoted exclusively, or almost so, to the groups described in the present volume.

I. OXEN

- ALLEN, J. A. The American Bisons, Living and Extinct. *Mem. Mus. Harvard*, vol. iv. No. 10 (1876).
- AULD, R. C. The Wild Cattle of Great Britain. *Amer. Naturalist*, vol. xxii. pp. 498-509 (1888).
- BLANFORD, W. T. On the Gaur (*Bos gaurus*) and its Allies. *Proc. Zool. Soc.* 1890, pp. 592-599, plate xlix.
- BLYTH, E. A Note on African Buffaloes. *Op. cit.* 1866, pp. 371-373.
- BOUVIER, E. L. L'Extermination du Bison Americain. *Le Naturaliste*, 1890, pp. 269-271, 285 and 286.
- BROOKE, Sir V. On African Buffaloes. *Proc. Zool. Soc.* 1873, pp. 474-484, plate xliii.
- Supplemental Notes on African Buffaloes. *Op. cit.* 1875, pp. 454-457, plate liv.
- On the Dwarf Buffalo of Pennant. *Ann. Mag. Nat. Hist.* ser. 4, vol. xiii. pp. 159 and 160 (1874).
- BÜCHNER, E. Das allmahliche Aussterben des Wisents (*Bison bonasus*, Linn.) im Forste von Bjelewjesha. *Mém. Acad. St. Pétersbourg*, ser. 8, vol. iii. No. 2 (1896).
- DAVISON, W. Note on the Sladang and the Sapio. *Proc. Zool. Soc.* 1889, pp. 447 and 448.
- EVANS, G. H. Notes on the Tsaing, or Banting (*Bos sondaicus*). *Journ. Bombay Nat. Hist. Soc.* vol. x. pp. 78-82 (1895).

- GRAY, J. E. On *Bos brachyceros*, the West African Buffalo, and the Dwarf Buffalo of Pennant. *Ann. Mag. Nat. Hist.* ser. 4, vol. xii. pp. 499 and 500 (1873).
 — On *Bos pumilus*. *Op. cit.* vol. xiii. pp. 258 and 259 (1874).
- HELLER, K. M. Die Urbüffel von Celebes, *Anoa depressicornis*, H. Smith. Dresden, 1889, 4to.
- HEUDE, P. M. Note sur un Buffle de Mindanao, *Bubalus mnanitensis*, Heude. *Mém. Hist. Nat. Emp. Chinois*, vol. iii. pp. 45-47, plate x. (1896).
- HODGSON, B. H. Description of the Gauri Gau of the Nepal Forest (*Bibos subhemachus*). *Journ. As. Soc. Bengal*, vol. vi. p. 499 (1837).
 — On the *Bibos*, Gauri Gau, or Gaurika Gau of the Indian Forests (*Bibos cavifrons*, *B. classicus*, *B. aristotelis*). *Op. cit.* pp. 745-749 (1837).
 — Illustrations of the Genera of the *Bovinae*; part. 1, Skeletons of *Bos*, *Bibos*, and *Bison*, the individuals examined being the Common Bull of Nepal, the Gowri Gao of Nepal, and the Yak. *Op. cit.* vol. x. pp. 449-470 (1841).
- HORNADAY, W. T. The Extermination of the American Bison. *Rep. U.S. Mus.* for 1886-87, pp. 369-548, plates i.-xxii. (1889).
- HUET, J. Les Bovidés. *Bull. Soc. Acclim. Paris*, vol. xxxviii. pp. 1-15 and 334-350 (1891).
- HUGHES, T. M'K. On the important Breeds of Cattle which have been recognised in the British Islands in successive periods. *Archæologia*, vol. iv. pp. 125-158 (1896).
- INVERARITY, J. D. The Indian Wild Buffalo. *Journ. Bombay Nat. Hist. Soc.* vol. x. pp. 41-52 (1895).
- JENTINK, F. A. On *Bubalus mindorensis*, Heude. *Notes Leyden Mus.* vol. xvi. pp. 199-204, plates viii.-xi. (1894).
- KELLER, C. Das afrikanische Zebu-Rind. *Festschrift Ges. Zurich*, 1896, pp. 454-487.
- LANGKAVEL, B. On the Geographical Distribution of the European and Caucasian Bison. *Zoologist*, ser. 3, vol. xix. pp. 1-10 (1895).
- LYDEKKER, R. Crania of Ruminants from the Indian Tertiaries. *Palæontologia Indica* (*Mem. Geol. Surv. Ind.*), ser. 10, vol. i. pp. 88-181, plates (1878-80).
 — On the Geographical Races of the Banting. *Proc. Zool. Soc.* 1898, pp. 276-278, plate xxv.
- NEHRING, H. Die Herberstein'schen Abbildungen des Ur und des Bison. *Landwirtsch. Jahrb.* vol. xxv. pp. 915-933 (1896).
- OUSTALET, E. Note sur l'*Anoa mindorensis*, Steere. *Bull. Mus. Paris*, 1895, pp. 202, 203.

- PECHUEL-LOESCHE, E. Afrikanische Büffel. *Zool. Jahrb. Syst.* vol. iii. pp. 704-724, plates xxvii. and xxviii. (1888).
- POLLOK, F. T. Indian Wild Cattle; the Tsine and the Gaur (miscalled Bison). *Zoologist*, ser. 4, vol. ii. pp. 1-10 (1898).
- POMEL, A. *Bubalus antiquus*. *Pal. Mon. Algérie*, 1893.
- Bœufs Taureaux. *Ibid.* 1894.
- RADDE, G. On the present Range of the European Bison in the Caucasus. *Proc. Zool. Soc.* 1893, pp. 175-177.
- RHOADS, S. N. Distribution of the American Bison in Pennsylvania, with remarks on a new Fossil Species. *Proc. Acad. Philadelphia*, 1895, pp. 244-248.
- Notes on Living and Extinct Species of North American *Boridae*. *Op. cit.* 1897, pp. 483-502, plate xii.
- RÖMER, F. Ueber C. E. von Baer's *Bos pallasii* aus dem Diluvium von Danzig. *Zeitschr. deutsch. Geol. Ges.* vol. xxviii. pp. 430-441 (1875).
- SARBO, J. The Wild Ox of Assam. *Proc. Zool. Soc.* 1883, pp. 142-144.
- SCHIEMENZ, P. Hat das Ur-Rind (*Bos primigenius*, Boj.) noch in historischer Zeit gelebt? *Biol. Centralblatt*, vol. xvii. pp. 793-798 (1897).
- STEWART, A. Notes on the Osteology of *Bison latifrons*, Leidy. *Kansas Quarterly*, vol. v. pp. 127-135 (1897).
- THOMAS, P. Recherches sur les Bovidés fossiles de l'Algérie. *Bull. Soc. Zool. France*, 1881, pp. 1-47, plates ii. and iii.
- WOOD, H. S. Description of, and Natural History Notes on the Burmese Wild Bull. *Zoologist*, ser. 4, vol. i. pp. 489-497 (1897).

II. MUSK-OXEN

- FEILDEN, H. W. The Distribution of the Musk-Ox in Greenland. *Zoologist*, ser. 3, vol. xix. pp. 41-44 (1895).

III. SHEEP AND GOATS

- ALLEN, J. A. Preliminary description of a new Mountain Sheep from the British North-West Territory. *Bull. Amer. Mus.* vol. ix. pp. 111-114, plates ii. and iii. (1897).
- BIDDULPH, J. Remarks on the Wild Sheep met with during his recent journey to Yarkand. *Proc. Zool. Soc.* 1875, pp. 157 and 158.

- BIDDULPH, J. On the Wild Sheep of Cyprus. *Proc. Zool. Soc.* 1884, pp. 593-596, plate lviii.
- On the Geographical Races of the Rocky Mountain Bighorn. *Op. cit.* 1885, pp. 678-684.
- BLANFORD, W. T. Remarks upon a series of Heads of *Ovis poli*. *Op. cit.* 1884, pp. 326-329.
- Remarks on heads of *Ovis ammon* from the North-West Altai, Central Asia, obtained by Major Cumberland. *Op. cit.* 1896, pp. 787 and 788.
- BLYTH, E. Monograph of the Species of the genus *Ovis*. *Op. cit.* 1840, pp. 12 and 13, and 62-79, and *Ann. Mag. Nat. Hist.* ser. 1, vol. vii. pp. 195-201, and 248-260 (1841).
- A Monograph of the Species of Wild Sheep. *Journ. As. Soc. Bengal*, vol. x. pp. 858-887 (1841).
- Der Himalaya-Steinbock. *Froriep Notizen*, vol. xviii. pp. 117-119 (1841).
- BROOKE, SIR V. and MR. B. On the Large Sheep of the Thian Shan and the other Asiatic Argali. *Proc. Zool. Soc.* 1875, pp. 509-526.
- BÜCHNER, E. Zur Geschichte der Kaukasischen Ture (*Capra caucasica* und *C. cylindricornis*). *Mém. Acad. St. Pétersbourg*, vol. xxxv. No. 8 (1887).
- BUXTON, E. N. Notes on the Wild Sheep of Algeria. *Proc. Zool. Soc.* 1890, pp. 361-363.
- DANFORD, G. Notes on the Wild Goat, *Capra ægagrus*, Gmelin. *Op. cit.* 1875, pp. 458-468.
- DINNIK, H. On the Caucasian Mountain-Goat (*Capra caucasica*, Gmelin). *Ann. Mag. Nat. Hist.* ser. 5, vol. xix. pp. 450-454 (1887).
- GUILLEMARD, F. H. H. Remarks on *Ovis nivicola*. *Proc. Zool. Soc.* 1885, pp. 675-678.
- HODGSON, B. H. The Wild Goat (*Capra jaral*) and the Wild Sheep (*Ovis nayaur*) of Nepal. *Asiat. Researches*, vol. xviii. pt. 2, pp. 129-138 (1833).
- On the Characters of the Jharal (*Capra jaral*, Hodgs.), with observations on the distinction between the genera *Capra* and *Ovis*. *Proc. Zool. Soc.* 1834, pp. 106-110.
- On the Wild Goats and Wild Sheep of the Himalaya, with remarks on the genera *Capra* and *Ovis*. *Journ. As. Soc. Bengal*, vol. iv. pp. 490-494, and 710 (1835).
- On the two Wild Species of Sheep (*Ovis ammonioides*, *O. nahoor*) inhabiting the Himalayan Region, with some brief remarks on the Craniological Characters of *Ovis* and its Allies. *Op. cit.* vol. x. pp. 230-234 (1840).

- HODGSON, B. H. On the Wild Sheep of Tibet (*Ovis ammonoides, mihi*). *Op. cit.* vol. xv. pp. 338-343 (1846).
- HUET, J. Liste des Espèces connues et décrites jusqu'à ce jour dans les Familles des Ovidés et Capridés. *Bull. Soc. Acclim. Paris*, vol. xxxii. pp. 241-255, 369-380, 470-478, and 561-570 (1891).
- LANGKAVEL, B. Die Europäische Muflon, das Mähnschaf, und der Cyprische Muflon. *Zool. Garten*. vol. xxxii. pp. 180-185 (1891).
- LIEBENWALDE, J. M. Dickhornschaf (*Ovis montana*) und Felsengebergziege (*Aploderus lanigerus*). *Op. cit.* vol. xxv. pp. 234-237, and 257-260 (1894).
- LYDEKKER, R. On the Zoological Position of the Bharal, or Blue Sheep, of Tibet. *Journ. As. Soc. Bengal*, vol. xlix. pp. 131-134 (1880).
- MATSCHIE, P. Ueber die Stellung von *Ovis nayaur*, Hodgson, im System der Säugethiere. *SB. Ges. naturfor. Berlin*, 1896, pp. 97-104 and 1897, p. 72.
- MERRIAM, C. H. *Ovis nelsoni*, a new Mountain Sheep from the desert region of Southern California. *Proc. Soc. Washington*, vol. xi. pp. 217, 218 (1897).
- NATHUSIUS, W. Ueber die systematische Stellung von *Capra* (?) *pyrenaica*, und die massgebende Bedeutung der Hornwindung. *Zool. Anzeiger*, 1888, pp. 333-338.
- NELSON, E. W. A new Geographical Race of the Mountain Sheep (*Ovis montana dalli*) from Alaska. *Proc. U. S. Mus.* vol. vii. pp. 12 and 13 (1884).
- NOACK, T. Ein neuer Steinbok aus Arabien. *Zool. Anzeiger*, 1896, pp. 353-356.
- PETERS, W. Ueber ein neues Argali-Schaf, *Ovis jubata*, aus dem östlichen Theile der Mongolei, im Norden von Peking. *Monatsbericht Akad. Berlin*, 1876, pp. 177-188, plates i.-iii.
- PONCINS, VISCOUNT E. DE. Shooting *Ovis polii* on the Pamirs. *Journ. Bombay Nat. Hist. Soc.* vol. x. pp. 53-62 (1895).
- REICHENAU, W. Die Alpensteinbok (*Capra ibex*, Linn.), ein Bewohner der Rheingau's während der Glacialperiode. *Neues Jahrb. Mineral.* 1896, vol. i. pp. 221-227.
- REICHENOW, A. Die Wildziege der Insel Jura. *Zool. Jahrb. Syst.* vol. iii. pp. 591-596, plate xv. (1888).
- SCLATER, P. L. Note on *Ovis polii* of Blyth. *Proc. Zool. Soc.* 1860, pp. 443, 444.
- Remarks on the various Species of Wild Goats. *Op. cit.* 1886, pp. 314-318, plates xxxi. and xxxii.

- SCLATER, P. L. Note on the Wild Goats of the Caucasus. *Proc. Zool. Soc.* 1887, pp. 552 and 553.
- STERNDALÉ, R. A. Hybridism between *Ovis hodgsoni* and *O. vignei*. *Op. cit.* 1886, pp. 205, 206.
- On a Hybrid, *Ovis hodgsoni* with *vignei*, discovered and shot by Mons. H. Dauvergne. *Journ. Bombay Nat. Hist. Soc.* vol. i. pp. 35-37, pl. i. (1886).
- STOLICZKA, F. Description of the *Ovis poli* of Blyth. *Proc. Zool. Soc.* 1874, pp. 425-427, plate liii.
- THOMAS, O. Preliminary description of a new Goat of the genus *Hemitragus* from South-Eastern Arabia. *Ann. Mag. Nat. Hist.* ser. 6, vol. xiii. pp. 365 and 366 (1894).

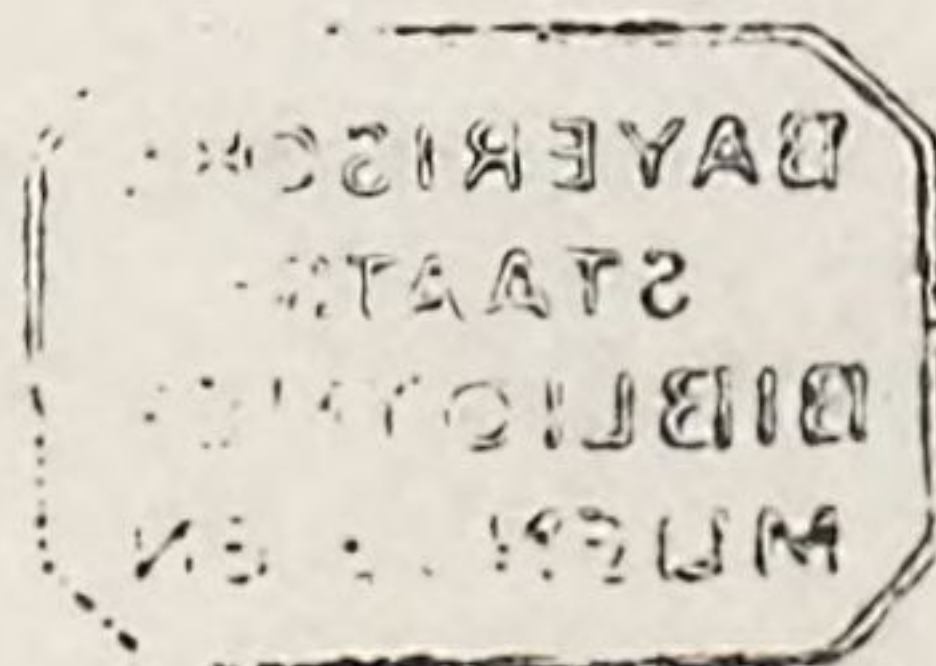


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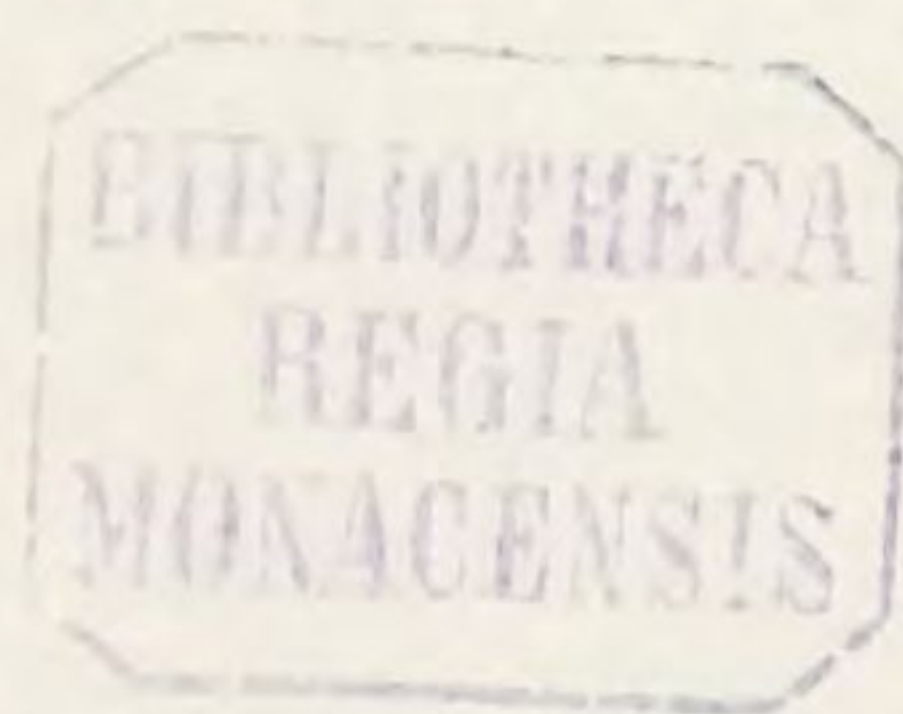
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THE END



EDINBURG
PRINTED
BY J. H. & J. W. B. 1841

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